TRENDS IN ALLUVIAL CHANNEL GEOMETRY AND STREAMFLOW : AN INVESTIGATION OF PATTERNS AND CONTROLS

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Trends in alluvial channel geometry and streamflow: an investigation of patterns and controls

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I dedicate this work to my mother, father, sister, and husband.
I thank my advisor, Michael B. Singer, and also James W. Kirchner
for their precious guidance at different stages of this work.
Finally, I express my gratitude to all those who provided me
with various forms of advice, friendship and support
over the course of these four years.

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Thesis abstract

Alluvial river channels are self-formed by the sediment-laden flow that is supplied to them from upstream and the interactions between this flow and the materials forming the channel bed and banks. Thus, any changes in the volumes of solid and liquid discharge or the resistance of the boundary materials can produce adjustments in the form of river channels over time. These shifts may increase or decrease the capacity of a channel to contain flood flows. However, despite a wealth of studies on the average geometry of river channels across different scales and climatic regimes, there has not yet been a systematic assessment of the rates and controls of *trends* in channel form. Using a combination of USGS data, including manual field measurements and mean daily streamflow data at hundreds of stream gages, this work is the first attempt to quantify how trends in channel geometry develop over decadal timescales and how they contribute to shifts in flood hazard, in comparison with trends in hydrology.

Findings reveal that two-thirds of all channel cross-sections studied exhibit significant trends in channel geometry. The majority of the investigated US river channels are eroding, with widening and deepening trends partially offset by decreases in average flow velocity. Rates of change are principally controlled by the channel size. Although large channels develop larger trends, changes are proportionally greater in small channels in percentage terms. A secondary major control is hydrology: rates of change in channel geometry are heightened by the variability and flashiness of flow regimes. Finally, results show that changing flood frequencies can only be accurately quantified when both hydrologic and geomorphic trends are accounted for, and that flood hazard is significantly increasing across the studied sites. These documented trends in channel geometry, hydraulics, and flood hazard have important implications for the management of alluvial channels, navigation, and riverside infrastructure.

Declarations

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I, Louise Jeanne Elizabeth Slater, hereby certify that this thesis, which is approximately 35,000 words in length, has been written by me, and that it is the record of work carried out by me, or principally by myself in collaboration with others as acknowledged, and that it has not been submitted in any previous application for a higher degree. I was admitted as a research student in September 2006 and as a candidate for the degree of Doctor of Philosophy in September 2010; the higher study for which this is a record was carried out in the University of St Andrews between September 2010 and August 2014.

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1.1. Controls on alluvial channel geometry

The majority of the world's natural stream channels are alluvial: that is, they have erodible boundaries which are self-formed by the transport of sediment-laden flow (Blench, 1952; Parker, 1978a, 1978b). Over time, the shape and capacity of alluvial channels adjust so that they can carry the volumes of water and bed sediment that are supplied to them from the upstream basin. Thus, numerous approaches have been developed to try to predict alluvial channel form based on empirical measurements of discharge and sediment and/or an analytical understanding of alluvial channel characteristics.

1.1.1. Alluvial channel form

The capacity of an alluvial channel is a function of the volume of streamflow that is carried in the river cross-section per unit time, and is typically quantified following the flow continuity equation:

$$Q = A \cdot U = w \cdot h \cdot U \qquad (1.1)$$

where Q is discharge, A is the cross-sectional flow area, U is the average cross-sectional flow velocity, w is width of the flow surface, and h is the average cross-sectional flow depth (Figure 1.1). As one travels downstream and streamflow volumes increase, alluvial channels tend to become wider, so the length of the channel boundaries (the wetted perimeter, WP) and the hydraulic radius (R_h, a measure of flow efficiency) also increase. WP and R_h are generally approximated as:

$$WP = 2 \cdot h + w \qquad R_h = \frac{A}{WP} \qquad (1.2)$$

The shape of alluvial channels is determined by the combined effects of Q, the sediment that is transported as bed-material load, and any vegetation on the bed or banks. Bed-material load is composed of grain sizes above a critical diameter of approximately 0.06 mm, below which there is little cohesive force among particles. These grains are conveyed along the channel bed at a velocity slower than that of the water, due to shear stresses acting parallel to the bed. This shear stress is approximated as:

$$\tau = \rho g R_h S \tag{1.3}$$

where ρ is the density of water, g is gravitational acceleration, and S is the slope of the hydraulic grade line. The conveyed bed load tends to cluster in bed and bar forms such as ripples and dunes, so alluvial cross-sections are rarely symmetrical. However, over human timescales, alluvial stream channels display an average or equilibrium cross-sectional size and shape (Schumm and Lichty, 1965), and are adjusted to carry the average volumes of water and sediment that are delivered from the upstream catchment.

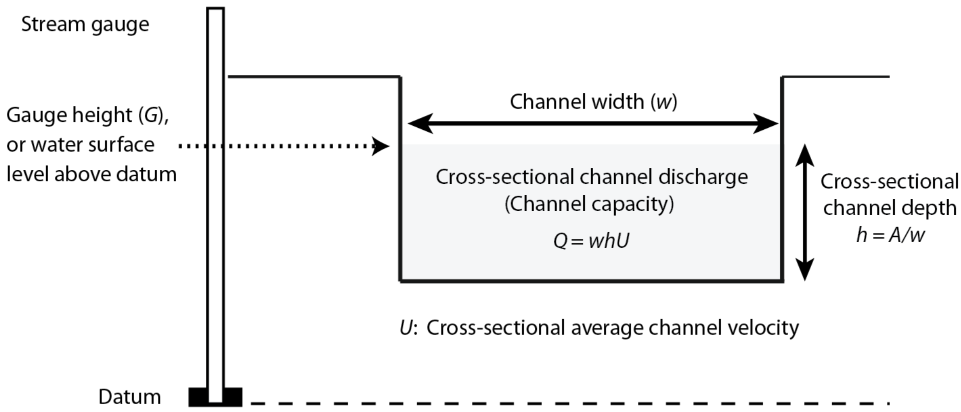


Figure 1.1. Idealised alluvial channel cross-section indicating cross-sectional channel flow area (A), width (w), average flow velocity (U), and average channel depth (h). The whU simplification is a convenience used for approximately regular cross-sections because A is hard to measure accurately.

The notion of channel equilibrium has been widely used to characterise the tendency of alluvial channels to adjust their shape to a mean or "quasi-equilibrium" form (Langbein and Leopold, 1964) that reflects the average volumes of flow and sediment that they must transport. This mean form is often referred to as the *channel geometry*, which can be simply described as the size and shape of a channel as measured by the width, the average depth, and average velocity of the channel cross-sectional flow.

An equilibrium river channel is one that has just the right capacity to transport the sediment and flow supplied from upstream. Over time, the channel capacity can fluctuate slightly, as it adjusts its geometry to carry the volumes of sediment and streamflow supplied from upstream. If the sediment load is too large or too little, the flow will erode or deposit sediment on the river bed. Over time, an equilibrium channel can even migrate across a floodplain but is expected to retain the same form, without aggrading nor degrading significantly. Dis-equilibrium of the channel geometry will develop only if the balance between supplied sediment and flow is disrupted notably over a prolonged period of time.

Various conceptual models have been developed to define how the average channel form is related to the streamflow and sediment supply. Historically, the first of these was empirical regime theory.

1.1.2. Empirical approaches for predicting channel form

1.1.2.1. Regime theory

Regime theory was introduced by British engineers excavating alluvial irrigation canals in Indian sand-beds in the late nineteenth century. Their aim was to design "stable" canals – i.e. canals that would have just the right capacity to transport the given discharge and sediment loads and remain clear of sediment. Kennedy (1895) was the first to fit power functions to the collected data. He noted that stable canals exhibit a relationship between mean flow velocity and mean flow depth of the form:

$$U = \alpha h^{\eta} \tag{1.4}$$

where the coefficient α and exponent η are both site-specific. Lindley (1919) advanced the term 'regime' to describe channel characteristics that could be predetermined as a function of the stream's water and sediment regime. These empirical relationships were later formalised by Lacey (1933, 1939), who related stream channel discharge, velocity, slope, wetted perimeter, and a 'silt factor' related to the bed-material grain size diameter. Collectively, the regime relationships allowed to determine the width, depth, and slope as a function of the channel-forming discharge (set at bankfull) and the bed-material diameter. Blench's equations (1969, 1952), developed using data from sand-bed Indian canals, calculate the width, depth, and slope based on the bed-material grain-size, bankfull discharge, bed sediment concentration and bank composition:

$$h = \left(\frac{F_S Q}{F_B^2}\right)^{\frac{1}{3}} \quad w = \left(\frac{F_B Q}{F_S}\right)^{0.5} \tag{1.5}$$

where F_B is a bed factor ($F_B = 1.9\sqrt{D_{50}}$), F_S a side factor (with values suggested by Blench ranging from 0.1 for friable banks to 0.30 for tough clay banks), and D_{50} the median grain size of the bed material. These equations have often been used to calculate 'stable' channel dimensions (Vanoni, 2006), however, all of the regression equations that were initially based on Indian canal data remain highly specific to the channels for which they were developed (namely, ripple-dune bed channels with low sediment transport and regular discharge) and thus are not truly generalizable.

1.1.2.2. Hydraulic geometry

Leopold and Maddock (1953) were the first to develop consistent regime relationships in natural alluvial stream and river channels. They formalised their relationships using stream gage data from 20 rivers of the Great Plains and southwest of the United States.

Based on the idea that alluvial channel capacity is adjusted over time to a relatively steady flow and sediment regime, they describe the "hydraulic geometry" of the channels by relating the average channel form to mean annual discharge in the form of power laws (Figure 1.2), as:

$$w = aQ^b \quad h = cQ^f \quad U = kQ^m \tag{1.6}$$

where Q is typically selected to represent the bankfull, channel forming discharge (Andrews, 1984) or the 2-year flow (Bray, 1982).

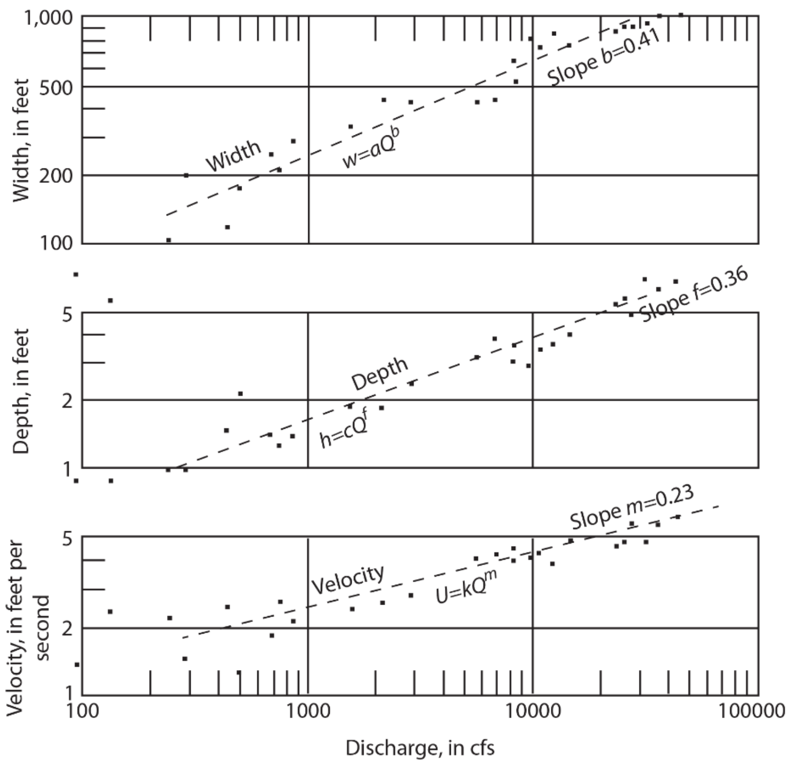


Figure 1.2. Hydraulic geometry power functions relating flow velocity, width and depth to discharge, at the Cheyenne River near Eagle Butte, South Dakota, re-drawn from Leopold and Maddock (1953, p. 5) with notation updated for consistency with this work.

Thus, hydraulic geometry can be used to predict (i) changes in velocity, width and depth as the volume of streamflow increases within an individual cross-section of set size and shape ('at-a-station' hydraulic geometry); or (ii) increases in channel size and shape, for a set discharge, as one travels down a basin (downstream hydraulic geometry).

Based on the continuity assumption (equation 1.1), Leopold and Maddock showed that:

$$Q = aQ^b \cdot cQ^f \cdot kQ^m = a \cdot c \cdot kQ^{b+f+m} \tag{1.7}$$

so $a \cdot c \cdot k = 1$ and $b + f + m = 1$. The scale factors (*a, c, k*) vary with the local characteristics of the bed and banks (Parker, 1979), such as grain size, bed load, bank silt/clay content, material type, and vegetation. The exponents (*b, f, m*) are much more constant across river sizes and types, with values typically *f* > *m* > *b* (Ferguson, 1986), depending on the materials forming the alluvial channel boundaries (Kolberg and Howard, 1995).

Overall, the empirical approach to hydraulic geometry remains a fairly good approximation of the relationship between discharge and channel form. However, the idea that channel form can be predicted using only the volume of discharge in the cross-section is simplistic and limits the applicability of these relationships in physiographically dissimilar environments. For example, densely vegetated channels tend to be narrower than less densely vegetated channels (Andrews, 1984; Charlton et al., 1978; Hey and Thorne, 1986).

Hydraulic geometry relationships were later improved using multivariate approaches that incorporated hydrologic and sediment descriptors such as mean discharge and mean diameter of bed sediment (Mosley, 1981), bed and bank material type/size, and bank vegetation/strength (Hey and Thorne, 1986). The relationships were also rendered more site-specific by incorporating bed slope (Bray, 1975) and sediment grain size (Lee and Julien, 2006); however, there remains a substantial degree of uncertainty in the ability of these relationships to predict channel form (Buffington et al., 2009). This uncertainty is largely due to the difficulties associated with measuring and generalizing the influence of the different controls on channel form, such as bed load, bank strength, and vegetation.

A further difficulty with hydraulic geometry relationships is that they assume that the cross-sectional flow velocity, width and average depth increase proportionally to discharge within the channel cross-section, following a power-law trend. This assumption renders them inappropriate for most irregular channel shapes. More importantly perhaps, these relationships assume that the coefficients and exponents remain constant and thus that there are *no significant changes in the cross-sectional shape* over time (Ferguson, 1986). However, sediment transport processes and any resulting shifts in channel geometry will affect the shape of the river channels and thus the accuracy of the corresponding rating curves substantially over time. Therefore, a more flexible approach in comparison with traditional hydraulic geometry methods would require the integration of confidence intervals based on possible fluctuations in channel form, using more flexible curves than simple power functions.

1.1.3. Analytical approaches for predicting channel form

Lane (1955) provided the first conceptualisation of the stable channel form to include bedload, grain size, and slope, as:

$$Q_b D \propto QS \tag{1.8}$$

where D is the grain size, and Q_b the bedload. The equation summarises his concept of 'channel response', which was that a change in any of the four variables must be accommodated by at least one of the other variables in order to restore channel equilibrium, however, it does not attempt to explain the driving forces behind changes in geometry over the long term.

Rational (or dimensionless) regime relationships have since been developed using analytical methods, to improve the dimensional empirical relationships (e.g. Leopold and Maddock (1953)) between the effective channel-forming flow and the corresponding predicted velocity, width and depth (Parker, 1979; Eaton and Church, 2007; Parker et al., 2007). Regime relationships are based on a system of physical equations that relate the channel characteristics (average flow velocity, width, average depth and slope) to the discharge and bedload transport rate, to solve for both dependent (supply of discharge and sediment) and independent (channel form) variables at the same time. The type of approach selected for predicting channel form in threshold channels depends on boundary mobility at design discharge (generally bankfull stage, i.e. the water-surface elevation at bankfull) (Shields et al., 2003).

1.1.3.1. Threshold channels

In channels with coarse alluvium beds, where sediment transport is negligible beneath bankfull (Koechlin, 1924; Lane, 1955), the channel form can be determined at the threshold of incipient motion by using imposed values of *Q*, slope, and grain size; hydraulic geometry formulae; a flow resistance equation, e.g. 1.3; and combining the continuity equation (1.1) with a uniform flow equation (e.g. Manning) to obtain the average depth and slope. The major limitation of the bankfull threshold method is that it cannot be used in channels with unstable form, such as sand-bed channels, where sediment transport occurs at lower, sub-bankfull stages (USDA, 2007).

1.1.3.2. Active-bed channels

In channels where the channel boundary is mobile and substantial bedload transport occurs, or when the hydraulic geometry cannot be determined from field data, an extremal hypothesis can be used to predict channel form (USDA, 2007), assuming that equilibrium channel form is attained for an 'optimal' condition. For example, the maximum efficiency hypothesis postulates that channels with substantial bedload will adjust their geometry to transport it with the most efficiency (Gilbert, 1914; Mackin, 1948; Schumm, 1960).

Computer programs are used to solve a resistance equation, a sediment transport equation and an extremal equation simultaneously, e.g. SAM (Copeland, 1994), or HEC-RAS (Brunner, 2010), producing a unique solution for width, depth and slope. Various extremal hypotheses have been proposed, including minimum power expenditure, minimum stream power (Chang, 1979), minimum variance or least work (Langbein, 1964), maximum energy loss, maximum flow resistance, maximum flow efficiency (Huang and Nanson, 2000), or maximum sediment transporting capacity. Despite the proliferation of extremal hypotheses, they have often been criticised for producing inaccurate results and for not accounting for channel adjustments (Ferguson, 1986; USDA, 2007). More recently however, Eaton and Church (2011, 2007) have shown that if the bed material transport is correctly related to stream power, a plausible physically based solution can be obtained.

1.2. How does alluvial channel geometry change over time?

Following equation 1.1, changes in channel capacity can be caused by a shift in the average velocity, the width, and/or the average depth of a cross-section.

1.2.1. Trends in bed elevation (depth)

Exner (1925, 1920) first formalised the idea that the change in alluvial channel bed elevation at any given point in the stream network can be calculated as a function of the amount of sediment entering and leaving the reach. Under equilibrium conditions where the entrainment rate of sediment is equal to the deposition rate (Figure 1.3), the change in bed elevation through time is balanced by the change in sediment flux along a reach. Thus, the one-dimensional principle of mass conservation can be written as:

$$(1-p)\frac{\partial z}{\partial t} = -\frac{\partial Q_b}{\partial x} \tag{1.9}$$

where p is the bed sediment porosity, z is the riverbed elevation above a fixed datum, t is time, Q_b is the flux of bedload sediment, and x is the longitudinal coordinate of the reach downstream. Changes in the two-dimensional cross-section of an alluvial channel at any point in the stream network are thus controlled by shifts in the spatial balance of sediment flux in the longitudinal profile (Figure 1.3), so bed elevation will rise with net deposition in a reach and vice versa.

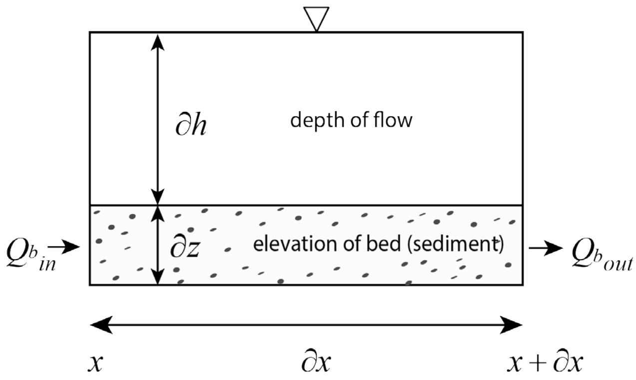


Figure 1.3. Schematic representation of the Exner equation, where z is the riverbed elevation above a fixed datum, x is the longitudinal coordinate of the reach downstream, $Q_{b\,in}$ and $Q_{b\,out}$ are the flux of bed sediment in and out of the channel per unit width, and h is the depth of the channel flow.

Most physically-based transport capacity models attempt to estimate the sediment transport capacity based on the difference between the energy that is available to transport the sediment that is supplied to the channel (the transport capacity) and the energy required to entrain it. Most often, the sediment transport capacity is determined as a function of the excess shear stress that acts on the stream bed (equation 1.3). The dimensionless shear stress required to move a sediment grain of a characteristic size, termed Shields parameter (Shields, 1936) can be written as:

$$\tau * = \frac{\tau}{\left(\rho_s - \rho\right) g D_i} \tag{1.10}$$

where ρ_s is the sediment mass density. The dimensionless critical shear stress required to initiate motion can also be written as a function of the Reynolds number (the dimensionless ratio of inertial forces to viscous forces) $\tau_b* = f\left(\mathrm{Re}_p^*\right)$. Values of τ_b* often range between 0.03 and 0.06, but can be much lower/higher if all sources of roughness are accounted for (e.g. Buffington and Montgomery (1997)). The amount of shear stress that is actually available for transport at any given time is termed the effective shear stress (τ'), and so bed sediment is entrained only when τ' exceeds the critical shear stress. This means that any changes in bed roughness (due to vegetation and/or grain size) will affect the capacity of the river flow to entrain/deposit sediment within the channel.

1.2.2. Trends in width

Alluvial channel banks tend to be more cohesive than the bed because they contain a greater proportion of fine grain sizes such as silt and clay, and can be consolidated by vegetation (Hickin, 1984). Thus, the resistance of stream banks to erosion is different to the resistance of stream beds, as it depends more on the strength of the bonds between particles than on the size of the particles (Knighton, 2014).

Erosion of riverbanks is primarily due to the hydraulic action of the velocity gradient near the banks (Odgaard, 1987). High velocity gradients along the base of the banks and on the outer banks of meander bends can lead to hydraulic shear, over-steepening, and bank failure (Rus et al., 2003; Simon and Thorne, 1996). The magnitude of bank failure processes is controlled by the climate, antecedent soil moisture conditions, and the presence of seasonal wetting and drying cycles which tend to weaken the cohesion of bank material (Thorne, 1982). Whether bank failures lead to widening or narrowing depends on the competence of the streams to evacuate the failed sediment and on rates of vegetation growth. If sediment benches remain exposed, colonisation by vegetation can induce further deposition and narrowing (Leopold and Wolman, 1957) and the establishment of a new, inset floodplain (Allred and Schmidt, 1999; ASCE, 1998).

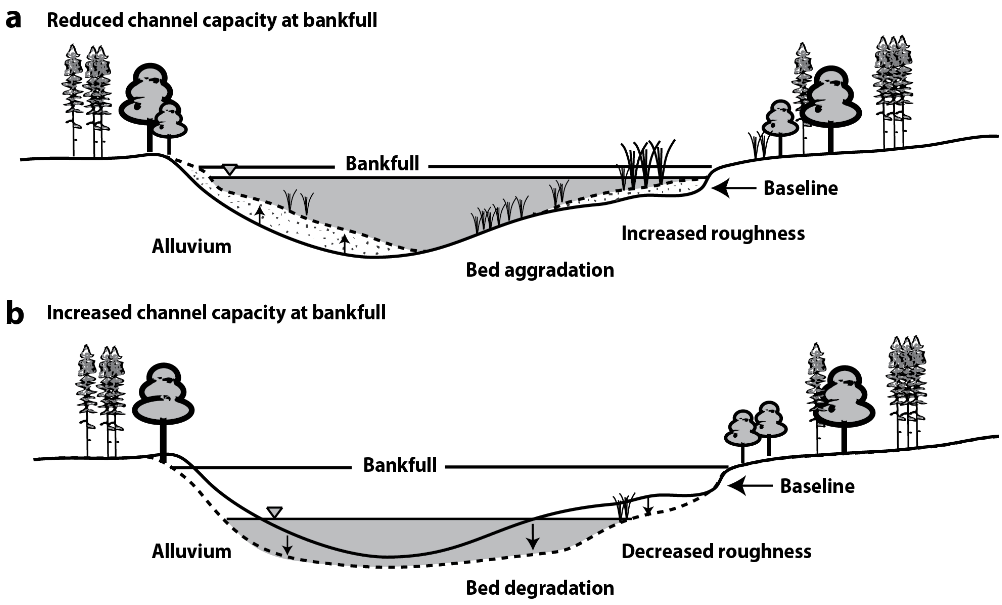


Figure 1.4. Diagram of a stream channel cross section, indicating (a) reduced channel capacity at bankfull, due to a decrease in channel cross-section flow area and velocity, and (b) increased channel capacity at bankfull, due to an increase in channel cross-section flow area and velocity.

1.2.3. Trends in velocity

The average cross-sectional velocity of flow is controlled by multiple sources of flow resistance within the river, the most important of which is channel boundary roughness (Bathurst, 1993). Under the assumption of steady uniform flow, the velocity of discharge can be considered to be in balance with the resistance along a fixed channel boundary (i.e., the flow is not accelerating or decelerating). In such a case, the principal sources of roughness in an alluvial channel (Bathurst, 1993) are: the grain size of the material that composes the bed and banks; the asymmetry and form of the channel; any bedforms, such as dunes and ripples; any obstructions, debris, roots, or logs in the channel; and finally, any vegetation growing in the channel.

These sources of in-channel roughness can change over time. For example, grain-size sorting during high flows (Hassan et al., 2006), or seasonal growth of submerged macrophytes within the wetted channel (Clarke, 2002; Cotton et al., 2006) can modify the average cross-sectional flow velocity. Thus, even if cross-sectional width and depth remain constant, following equation 1.1, a decrease in velocity will reduce the channel capacity, and vice-versa (Figure 1.4).

1.3. Causes of changes in channel geometry over decadal timescales

In many basins around the world, major anthropogenic and climatic changes have modified the volumes of water and sediment transiting through river systems, leading to temporal trends in channel form.

1.3.1. Direct changes to flow and sediment supply

Reservoir construction has been one of the leading drivers of changes in alluvial channel capacity over the past century. The magnitude of shifts in river channel geometry above and below dams is often a direct function of the 'trap efficiency' of reservoirs (Brune, 1953), i.e. the ratio of storage capacity to inflow, which determines the potential of the dam to control the magnitude and timing of the annual flood peak (Singer, 2007). Thus highly 'efficient' dams can have notable effects on flow regimes and alluvial channel morphology. For example, reductions in streamflow can lead to channel narrowing and simplification below the dams (Graf, 2006; Van Steeter and Pitlick, 1998), with effects persisting over tens of kilometres (Gregory and Park, 1974). The water that is released immediately below a dam is termed 'hungry' (Kondolf, 1997) because it is sediment-starved and has excess energy and transport capacity. Hungry water erodes the bed and banks, so that the bed material coarsens until the channels attain a new equilibrium and can no longer incise (Williams and Wolman, 1984). The eroded sediment is deposited further downstream, resulting in channel aggradation lower in the basin (Schmidt and Wilcock, 2008).

Anthropogenic water usage also has a direct impact on the conveyance capacity of alluvial channels, as diversions, transfers, and water extractions for irrigation or industrial uses can reduce the available discharge without modifying the sediment supply. The resulting decreases in sediment transport capacity cause the channels to aggrade, depending on the volumes and/or seasonal timing of extracted flows (Knighton, 2014).

Shifts in the volumes of sediment supplied to channels can also perturb equilibrium. Reservoirs are a primary interruption in longitudinal sediment flux (Andrews, 1986; Graf, 2006; Williams and Wolman, 1984) as they cause sediment to settle in the reservoir above the dam, so in-stream sedimentation gradually reduces the channel slope and capacity. The resulting direction and magnitude of shifts in channel morphology will depend on the difference between pre- and post-dam sediment supply (Schmidt and Wilcock, 2008). As a result of decreased sediment supply due to dams, aggregate mining, and bank protection, downstream grain size transitions can extend and migrate upstream (Singer, 2010), with consequences for channel roughness, and thus for the average flow velocity and capacity of the channel cross-section.

Climatic changes also perturb the water and sediment volumes that are supplied to channels. For a constant infiltration rate, increases in mean annual precipitation can heighten runoff volumes, resulting in increased transport capacity and channel widening/degradation (Schumm, 1969). In most climates however, the relationship between precipitation and erosion rates is non-linear due to associated changes in vegetation and land coverage. As mean precipitation increases, so does vegetation, thereby suppressing the sediment loads and runoff that are supplied to the stream channels (Collins and Bras, 2010, 2008; Langbein and Schumm, 1958). Thus, a shift towards a more humid climate can also lead to channel narrowing from vegetation growth, depending on the initial climate.

The *effect* of climate change on river channels will therefore vary according to the manner in which the initial volumes and timing of runoff and sediment delivered to streams are modified (Molnar et al., 2006). Changes in the variability of precipitation can have a greater influence on stream competence than changes in the mean annual precipitation. As flow variability increases, so does the proportion of sediment load that is carried by high discharges (Tucker and Bras, 2000; Wolman and Miller, 1960). Yet it remains uncertain how flow variability can be altered in different contexts, as runoff is generally more variable in small basins (Wolman and Miller, 1960) and in arid regions (Farquharson et al., 1992; Friedman and Auble, 2000; Osterkamp and Friedman, 2000; Pitlick, 1994; Turcotte and Greene, 1993).

Finally, some of the most direct changes in channel capacity result from engineering works such as river channelization, construction of levees, flood control structures, channel straightening, and resectioning through meander cut-offs (Meade and Moody, 2010). Such modifications generally serve to control the flow, protect land from flood waters, maintain navigation ways, and/or free up land for other uses (Knighton, 2014), but they also modify sediment transport rates and flow velocity through their effects on vegetation and grain size.

1.3.2. Indirect effects

Land-use changes, including clear-cut siviliculture, site burning, agriculture, heavy cattle grazing, and increases in impervious land surface from road building and urbanization can also affect channel form. By reducing water infiltration from precipitation, weakening soil cohesion and/or increasing soil compaction (Trimble and Mendel, 1995) such practices tend to modify peak flows (Beschta et al., 2000), runoff magnitudes (Hammer, 1972; Kundzewicz, 2012), hillslope soil erosion (Johnson and Beschta, 1980), and sediment yields to channels (Dunne, 1979). The excess flow can cause alluvial channels to widen, degrade/aggrade, and straighten (Hammer, 1972; Leopold, 1968; Wolman, 1967), with effect magnitude varying by intensity and extent of land-use changes, and sometimes persisting for over a century (Napolitano, 1998). Thus, numerous causes can contribute to changes in channel capacity, and can have substantial repercussions on flood hazard.

1.4. Flood hazard

One the most vital but least well understood consequences of changes in channel capacity is their effect on flood hazard.

1.4.1. Uncertainties associated with flood hazard mapping

Freshwater flood hazard is the chance of a flood event occurring, and is characterised by the probability and magnitude of streamflows above flood levels (Merz et al., 2012). In densely populated areas, flood hazards pose a high risk to society. The United States Federal Emergency Management Agency (FEMA)'s National Flood Insurance Program (NFIP) has about 5.6 million policies (King, 2013) and was intended to be self-supporting. Yet, miscalculated insurance premiums are currently responsible for a deficit of about $200 million annually (Gaffigan, 2014). The Biggert-Waters Act (Biggert-Waters Flood Insurance Reform Act, 2012) was recently passed to address this issue by adjusting insurance premiums with updated flood hazard maps (King, 2013).

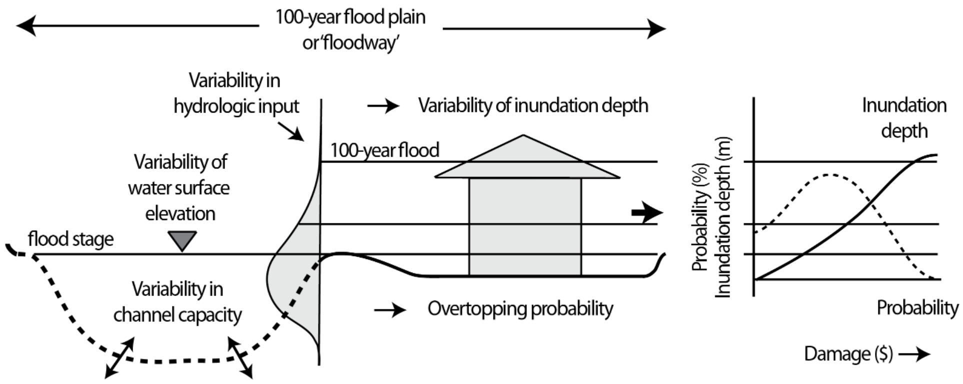


Figure 1.5. Scheme of the methodological approach used to quantify flood damage probabilities. Modified after Neuhold et al. (2009).

Flood hazard zonation maps are generally based on the passing of design floods through a network to determine the variability in inundation depth, as well as its associated probability and damage (Figure 1.5). However, numerous uncertainties are associated with flood inundation mapping, arising from sources such as the hydrologic/topographic data, modelling parameters and techniques, all of which propagate and affect the final flood inundation map (Bales and Wagner, 2009; Merwade et al., 2008; Neal et al., 2013).

1.4.2. Effects of channel changes on flood hazard

One major source of uncertainty in the calculation of flood hazard is the capacity of the river channel to contain flood flows. Shifts in channel capacity are rarely taken into account in flood inundation estimates (Neuhold et al., 2009) because they are not believed to affect inundation depths substantially (Bates et al., 2005) – mostly because no-one has yet attempted to quantify their influence on flood hazards. Uncertainties in flood hazard mapping due to the effects of shifts in channel geometry are only just beginning to be recognised and assessed in hydraulic modelling (Neal et al., 2013; Neuhold et al., 2009; Wong et al., 2014).

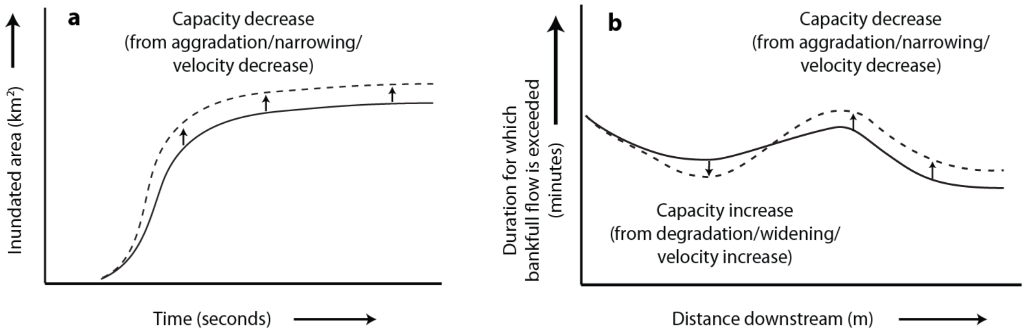


Figure 1.6. Effect of channel contraction within a given reach on (a) inundated area versus time, and (b) flood duration downstream, for a flood of a given magnitude.

Changes in channel capacity can modify the extent and duration of inundation (Lane et al., 2007; Pinter and Heine, 2005; Pinter et al., 2006b; Raven et al., 2009; Stover and Montgomery, 2001), even if the magnitude of flood flows remains constant. For example, a decrease in cross-sectional capacity will cause streamflow to rise out of the banks more rapidly and inundate a larger area than before (Figure 1.6a), and increase the duration of overbank flow (Figure 1.6b). A few studies have stressed the need to incorporate the effects of changes in channel geometry in flood risk management (Lane et al., 2007; Sear et al., 1995), yet these shifts are still being ignored, due to the lack of data.

Thus, it is important to be able to quantify how shifts in channel geometry affect flood hazard frequency. To determine how alluvial river channels are evolving in response to these direct and indirect perturbations to water and sediment supply, we use manual field measurements from the United States Geological Survey (USGS). The methods described in this thesis could be applied to any channel cross-section with hydrometric data, but USGS datasets are publicly available and contain detailed measurements of the kinds needed to do such analysis. This work can lead to better and more robust measurements of channel capacity and their effects on flood hazard frequency for drainage basins around the world.

1.5. How is channel geometry measured?

The USGS began measuring stream flows in 1889 on the Rio Grande at Embudo, New Mexico (Gunn et al., 2014). In 2003, through the National Streamflow Information Program (NSIP), the entire database of historic manual field measurements from stream gaging stations was made available to the public for approximately 7,600 active stream gages (USGS NSIP, 2011). These field channel measurements and daily streamflow data are collected for a variety of purposes, including the management of water resources, engineering designs, navigation, power production, flood forecasting, and water quality and habitat assessments (Hester et al., 2006; USGS NSIP, 2011).

1.5.1. 'Manual' flow measurements

Manual field measurements of channel cross-sections are made by the USGS in order to calculate the streamflow (Rantz, 1982a). Q is not measured directly, but is computed based on rating curves between stage and discharge. To develop and maintain these rating curves, flow must be measured 'manually' at regular intervals over time. Historically, these streamflow measurements were typically made by dividing a channel into approximately 25 small segments, and measuring the average velocity, width, and average flow depth for each of these individual segments, as in Figure 1.7. The total discharge within the channel cross-section was then computed as the sum of the discharge measured for each segment:

$$Q = \sum_{i=1}^{N} (w_i \times h_i \times u_i) \tag{1.11}$$

where N is the number of segments in the cross section, w_i is the width of segment i, h_i is the depth of segment i, and u_i is the average velocity in segment i, providing measurements of channel dimensions with high precision and confidence levels.

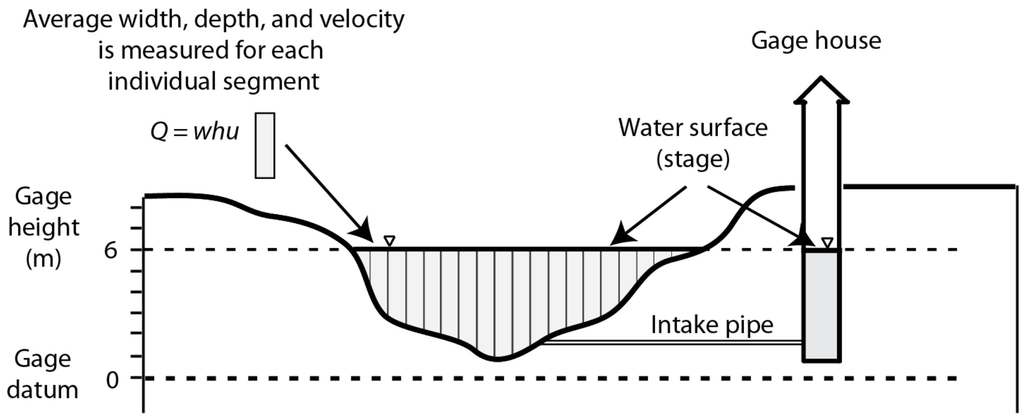


Figure 1.7. Schematic of a USGS stream gaging station. Streamflow (Q) is measured as the product of cross-sectional width (w), depth (h), and velocity (u) for each segment of the stream channel. Stream gage increments are indicated on the left. Modified from Smelser & Schmidt (1998).

In the last decade, more efficient methods have been introduced with the development of acoustic Doppler current profilers (ADCPs) which can be mounted on moving boats (Mueller and Wagner, 2009). ADCPs measure the water velocity using ultrasonic sound, a principle discovered by Christian Johann Doppler (1842). An ADCP typically emits three or four acoustic signals, aimed about 20-30 degrees from the vertical, to measure the velocity of the water relative to the boat. The Doppler shift of signals that are reflected from the bed of the channel allow to "bottom track" the velocity of the boat. Global positioning systems (GPS) are also increasingly being used on the boats to georeferenced measurement location. Flow measurements made using ADCPs are now much faster and easier measurements than those made using traditional current-meter methods. They also provide enhanced safety for the field officers, particularly in conditions where the flow is rapidly changing such as unsteady or bidirectional (e.g. tidally-affected) waters.

1.5.2. Rating curves

When a new gaging station is established, a datum is determined at some point beneath the channel bed and is intended to remain permanent throughout the life of the station (Figure 1.7). Subsequent measurements of stage are all referenced to this datum, and plotting flow *versus* stage allows one to develop a stage-discharge relationship that is specific to each channel for a given time-period. Thus, for a new gaging station, it is recommended that discharge measurements are made for a comprehensive range of stage to develop the site's rating curve (Rantz, 1982b, p. 285). The stage-discharge relationship is usually plotted using an equation of the form:

$$Q = \alpha(G - z_0)^N \tag{1.12}$$

where α is a site-specific coefficient, G is the stage, z_0 is the gage height for which the bed elevation above the datum is zero, and N is the exponent of the rating curve (Figure 1.8). The values of α and N are obtained by regression. The curve is used to report mean daily discharge from automated measurements of G; so α, z_0, and N are assumed constant (Isaacson and Coonrod, 2011; Rantz, 1982b, p. 289), and if the channel capacity remains stable over time, a given discharge will always correspond to the same gage height.

However, as alluvial river channels adjust their geometry and roughness, the stage-discharge relationship can be rendered inaccurate over time. The USGS recommends that the curve be verified a minimum of ten times per year, or less if the stage-discharge relationship is stable over time (Rantz, 1982b, p.285). Verifications are made especially following hydrological extremes (droughts, floods, ice), during which the channel cross-section is more likely to scour or fill in with sediment or vegetation. To determine whether the last-used rating is still applicable, measured discharges are compared with the discharges obtained for the same values of stage on the rating curve. As long as the departures are random in sign (plus and minus), within ±5 percent, and short-lived (less than a month or two) the last-used rating is kept in effect (Rantz, 1982b). Otherwise, a rating shift is calculated as the difference between the stage obtained from the rating curve and the stage measured in the field (Figure 1.8).

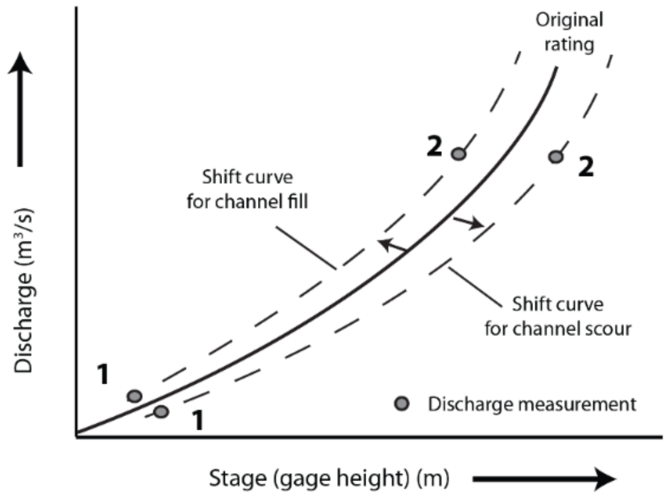


Figure 1.8. Schematic of a stage-discharge rating and the shift in stage-discharge rating caused by a change in channel capacity. Modified after Rantz (1982b).

1.5.3. Gaging site characteristics

In order to obtain good rating curves for assessment of streamflow in a channel cross-section, the USGS outlined a list of nine 'ideal' gaging site characteristics, which were intended to provide the USGS with a stable set of gaging stations. These include: a straight stream course for about 300 ft. (approx. 90 m) upstream and downstream from the gage site; flow that is confined to one channel at all stages; a streambed that is not subject to scour and fill and is free of aquatic growth; banks that are permanent, high enough to contain floods, and free of brush; unchanging natural controls in the form of a bedrock outcrop or other stable riffle for low flow and a channel constriction for high flow-or all stages; the presence of a pool upstream from the control at extremely low stages to ensure a recording of stage at low flow, and to avoid high velocities during periods of high flow; sufficient distance from the confluence with another stream or from tidal effect to avoid any influence on the stage at the gage site; the possibility of measuring discharge at all stages within reasonable proximity of the gage site; and ease of access for installation and operation of the gaging station (Rantz, 1982a). However, USGS stream gages do not necessarily meet all the criteria, since a gaging site can be chosen for accessibility or other reasons.

1.5.4. Biases arising from gaging site characteristics

It is important to recognise from the outset the bias that arises from using measurements made at USGS gaging sites to detect changes in alluvial channel geometry. Because of the 'ideal' gaging site characteristics listed above (i.e. straightness of the stream course, stability of the bed and banks over time, lack of vegetation), stream gages are often sited in stable stream channels. On the one hand, these gaging site characteristics provide an advantage for the evaluation of trends in channel geometry, as they ensure that the quantified trends are less likely to be affected by local variations in sediment supply, channel asymmetry and channel roughness. It is also easier to estimate trends in channel geometry in single-thread channels that are not affected by lateral migration.

However, there are also limitations to consider. These 'stable' channels can change relatively little over time in comparison with reaches located in other parts of the drainage basin, thus any computed morphological trends will likely produce *conservative* estimates of change. Ideally, one would select stream gages through random stratified sampling approach, but in practice one is limited by the number of stream gages with sufficient channel measurements made consistently in one same location over time.

1.6. Methods for the detection of channel change

Manual field measurements of stream channels associated with streamflow measurements have been used in the past to quantify geomorphic changes in cross-sectional channel form (Juracek and Fitzpatrick, 2009).

1.6.1. Systematic methods using USGS field data

Some semi-automated methods to assess change in channel cross-sections have already been developed based on USGS manual field measurements: these include equal discharge and residual analysis. The most widely-used semi-automated method for quantifying the effect of changes in channel capacity is equal discharge analysis (Gilbert, 1917), termed "specific gage analysis" by Blench (1969). The method consists in selecting a reference discharge to observe the associated trend in stage over time (Figure 1.9). If the stage for the reference discharge decreases over time, then the channel capacity must have increased (through bed degradation, widening, and/or decreased roughness), while an increase indicates that the channel capacity must have decreased (through aggradation, narrowing, and/or increased roughness).

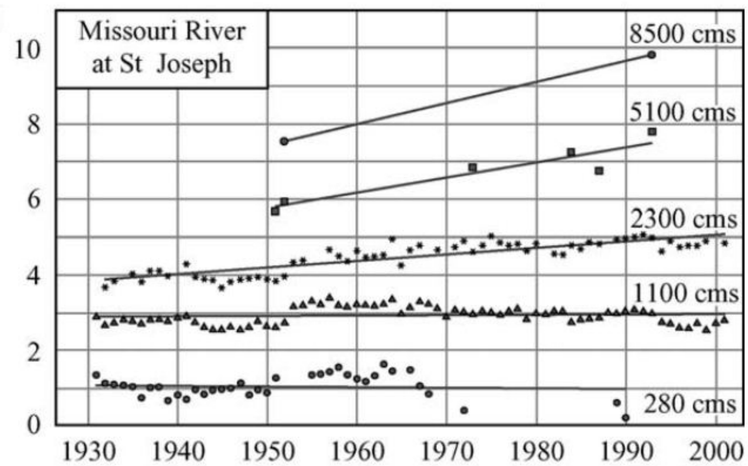


Figure 1.9. Example of the equal discharge method, showing water stages associated with five fixed discharges. The method reveals any changes in the stage-discharge relationship within

the channel cross section. Here, there is a decrease in stage for low flow (280 m^3/s), and rising stage for high flow (2300, 5100 and 8500 m^3/s). Taken from Pinter & Heine (2005).

Equal discharge analysis was initially used to infer trends in the channel bed elevation (Gilbert, 1917; Williams and Wolman, 1984). In recent decades, the method has been used to determine how changes in channel capacity affect flood stage: James (1997) found that channel incision of the lower American River decreased flow stages over the 20th century; while Stover and Montgomery (2001) showed that riverbed aggradation was the primary cause of recent increases in flood frequency along the Skokomish River, Washington.

However, several difficulties are associated with the equal discharge method. First, it requires long time series of stage and discharge, with correspondingly-detailed manual field channel measurements of channel form. Such detailed time series of stage are rare and difficult to obtain, because stage records are most often sparse and incomplete. This limitation can be overcome for the detection of flood stage trends by creating synthetic discharges, as in Jemberie et al. (2008). However, it is uncommon to find detailed manual field channel measurements for a fixed level of discharge, particularly at high flows. A second difficulty with this method is that the discharge is typically inferred from the stage (instead of using actual measurements), which makes the analysis circular, and limits the accuracy of the relationship between stage and capacity, particularly for the highest flows (Figure 1.9) (Lane et al., 2007).

Residual analysis circumvents some of the difficulties associated with the equal discharge approach by fitting a curve to the regression relationship between stage and discharge, and plotting the temporal trend of the regression residuals (i.e. the observed minus the predicted channel characteristics) (James, 1997, 1991). This approach removes the influence of differences in stage, as long as the residuals are approximately equivalent (regularly distributed) for all levels of stage. In the past, rating curves relating discharge, velocity, width, or depth to stage were typically fit as power (e.g. Leopold and Maddock (1953), Figure 1.2) or as polynomial (Richards, 1976) curves, however, if these curves are poor fits to the data (i.e. insufficiently flexible), there will be greater variance at one point in the curve than for the rest of the curve, producing inaccurate time trends.

1.6.2. Remote sensing methods

With remote sensing methods, temporal changes in channel geometry are quantified by subtraction of repeatedly digitised surfaces. Maps, photographs and satellite imagery are generally used to quantify changes in channel width and/or vegetation (e.g. Henshaw et al. (2013), Piégay et al (2009)). These methods are rapid and the data are often publicly accessible free of charge (e.g. Google Earth imagery). Three-dimensional digital terrain models (DTMs), obtained from photogrammetry, terrestrial/airborne laser scanning (TLS or ALS), GPS, and Light detection and ranging (LiDAR) methods, are increasingly being used to quantify channel change over 'hyperscale' time periods, i.e. ranging from seconds to decades (e.g. Brasington et al. (2000). Raven et al. (2009)). Less expensive methods include structure-from-motion photogrammetry (Sfm), which can be obtained with a digital hand-held camera. The advantages of DTMs are the high resolution (up to +/-0.005m), the three dimensional nature of the data, and the possibility of detecting landscape features automatically using GIS-based algorithms (e.g. Clubb et al. (2014)). However, most remote sensing methods cannot yet be used to detect change in wetted channels. Associated difficulties, due to georeferencing issues and the presence of riparian vegetation, are gradually being overcome.

1.6.3. Site-specific measurement methods

Numerous site-specific methods exist for measuring changes in channel capacity and lateral migration rates in individual rivers, but these are relatively labour-intensive, of inconstant accuracy, and can disturb the landscape to varying degrees. Scour chains and erosion pins are used to quantify lateral migration rates. Erosion pins are steel nails of 0.5 to 1.5 m in length, with a diameter of ~5 to 15 mm, which are set in the banks parallel to water surface, in vertical arrays (e.g. Stock et al. (2005)), so the distance between the end of the rod and the bank face can be measured periodically. Scour chains are installed by driving a temporary pipe into the riverbed (~1 m) (e.g. Levy et al. (2011)), so the change in vertical chain length is measured over time. Both methods are relatively simple and inexpensive, but they are point-specific; the depth of re-deposition is difficult to measure with certainty; and the pins/chains are not always easily accessible or recoverable.

Planimetric survey involves the mapping of the channel planform, using plane table, baseline survey (chain-and-offset mapping), tacheometry (theodolites), or electronic distance measuring (EDM) (e.g. Lawler (1993)) methods, which are relatively inexpensive but can be difficult to replicate. Finally, botanical evidence consists of dating annual growth layers in woody plants, such as ring width and ring density, to obtain chronological data, using dendrogeomorphology; lichenometry; tree-ring isotope dendrochronology methods (e.g. Shroder (1980), Strunk (1997)). These allow quantification of historical migration rates and comparison with climate data.

1.7. Thesis objectives and structure

1.7.1. Aims

As a result of efforts to validate stage-discharge rating curves, most USGS stream gages have a collection of historical manual field measurements of cross-sectional flow area, width, and velocity, for various levels of stage at different times of year, and often over periods of several decades. These measurements provide a window into the evolution of channel geometry (i.e. width, area and depth) with respect to historical records of streamflow. However, manual field channel measurements have never been used to quantify changes in alluvial channel geometry in any systematic fashion. The principal objectives of this thesis are therefore as follows: to develop a statistically robust procedure that allows to quantify changes in alluvial channel bed elevation/depth, flow area, width, and mean flow velocity over time (chapters 2-4); to determine the principal controls on rates of change in cross-sectional channel geometry across the United States (chapters 2 and 4); to quantify the relationship between changes in alluvial channel geometry and trends in flood hazard, independently from the effects of any changes in streamflow (chapter 3); and finally, to evaluate how trends in channel width, mean flow depth, and mean flow velocity contribute to shifts in channel capacity in rivers of varying size and flow regime (chapter 4).

1.7.2. Thesis structure

Chapter 2. Trends in alluvial riverbeds: the imprint of climate and climate change

This chapter forms the basis of a paper that was published in March 2013: Slater, L.J., Singer, M.B., 2013. Imprint of climate and climate change in alluvial riverbeds: Continental United States, 1950-2011. Geology 41, 595–598. LJS planned and executed the study (including all statistical analyses and figures) and prepared the chapter for publication. MBS provided guidance in the design of the study and contributed to writing/editing the work.

Alluvial riverbeds are typically assumed to fluctuate over time as a function of available discharge and sediment supply. However, trends in riverbed elevation have never been assessed systematically over broad spatial scales. Chapter two investigates the time scales over which trends and variability are expressed in riverbed elevations at 915 reference gaging sites across the conterminous USA. The aims of the chapter are to quantify trends in riverbed elevation across the USA, to investigate whether climate is imprinted in the rates of riverbed elevation change, to assess the variability in riverbed trends across climatic and topographic gradients, and to determine how changes in climate may affect the spatial variability in riverbed elevation trends across the United States.

Chapter 3. Hydrologic and geomorphic drivers of changing flood hazards

This chapter forms the basis of a paper that was published in January 2015: Slater, L.J., Singer, M.B., Kirchner, J.W., 2015. Hydrologic versus geomorphic drivers of trends in flood hazard. Geophysical Research Letters 42, 1–7. LJS planned and executed the study (including all statistical analyses and figures) and prepared the chapter for publication. MBS and JWK provided guidance in the design of the study and contributed to writing/editing the work.

The elevated proportion of gaging sites displaying significant trends in riverbed elevation across the U.S. led me to question what the potential impacts of such trends may be for flood hazard frequency, since no work has yet quantified the relationship between temporal changes in channel capacity and flood frequency. The aims of this chapter are thus to quantify the separate effects of trends in channel capacity and streamflow on flood hazard frequency in terms of their magnitudes and directions, to determine whether trends in channel capacity and flood-stage flow frequency are acting in concert or offsetting each other to raise or lower flood hazard frequency, and to better characterise overall trends in flood hazard frequency.

Chapter 4. Trends in the cross-sectional velocity, width and depth of alluvial channel flow

This chapter was entirely planned and executed by LJS. MBS and JWK provided some guidance in the design of the methods.

Finally, the widespread effects of changes in channel capacity on flood hazard found in chapter three raise the question of *how* such trends in alluvial channel capacity actually develop over time. This final chapter presents the first systematic assessment of trends in alluvial channel geometry at 973 stream gages across the United States. The aims of this chapter are to assess the magnitudes of trends in the cross-sectional average velocity, width and depth of streamflow, to distinguish the relationship between the magnitudes of these trends and the average capacity and flow regime of river channels, to assess whether shifts in velocity, width and depth are primarily additive/offsetting, and finally, to evaluate whether shifts in channel capacity occur principally as a result of trends in cross-sectional flow velocity, width, or average cross-sectional flow depth.

2. Chapter 2. Trends in alluvial riverbeds: the imprint of climate and climate change

2.1. Introduction

Alluvial riverbed elevation – i.e. the height of the riverbed, measured above a fixed datum (Figure 2.1) – is controlled by the amount of alluvial cover that is supplied to the channel cross-section at any given point in the river network. As such, it responds to the balance between sediment supply and transport capacity, which is largely dependent on climate and its translation into fluvial discharge. Changes in riverbed elevation are crucial drivers of landscape evolution (Tucker and Slingerland, 1997), alluvial stratigraphy (Daniels, 2008), flood hazard (Pinter and Heine, 2005; Wong et al., 2014) and the distribution of aquatic habitat in the stream network (ASCE Task Committee on Sediment Transport and Aquatic Habitats, 1992; Van Steeter and Pitlick, 1998).

Over societally relevant timescales, anthropogenic activity (Syvitski et al., 2005) and climate (Inman and Jenkins, 1999) govern changes in sediment production and flux through fluvial systems (Tucker and Bras, 2000), and by extension, they affect alluvial riverbeds (Daniels, 2008; Simon, 1989; Tucker and Slingerland, 1997; Williams and Wolman, 1984). However, in contrast to substantial work documenting anthropogenic impacts in alluvial rivers (Gregory, 2006), there exists no corresponding understanding of climatic riverbed signatures, due to a lack of systematic observations spanning gradients of drainage area and climate (Kochel, 1988).

2.1.1. A climatic imprint in riverbed elevation?

Previous work has suggested that climate etches its signature in river channels (Hartshorn et al., 2002; Molnar et al., 2006; Stark et al., 2010), but it is not clear over what timescales this imprint develops, nor how precipitation changes are reflected in riverbed elevation.

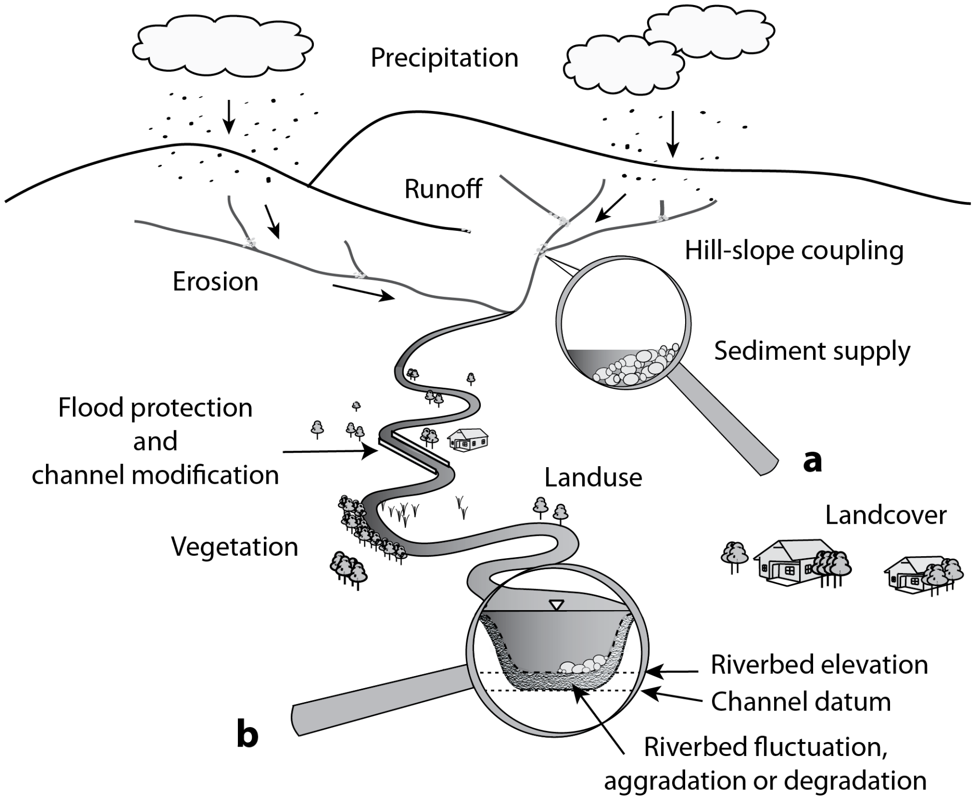


Figure 2.1. Schematic of the controls on riverbed elevation in a drainage basin. Sediment supply accumulates in tributary junctions and is transferred downstream episodically, when floods occur. Within the channel cross-section, water surface level (stage) is indicated by a triangle above the water surface.

Precipitation generates runoff and erodes sediment from various parts of a drainage basin; a proportion of this sediment forms the riverbed, with grain sizes that provide resistance to subsequent transport (Figure 2.1a). This bed sediment is transported through the river network by streamflow once it exceeds the entrainment threshold. The frequency of such transport is affected by climatic regimes (Groisman et al., 2001; Molnar et al., 2006; O'Connor, 2004; Pitlick, 1994), producing reach-scale scour and fill (short-term variability) or aggradation/degradation (long-term trends) over multiple storm cycles (Figure 2.1b).

For steady basin conditions, changes in riverbed elevation reflect the balance between sediment supply to channels and net sediment flux through the fluvial system. Yet, shifts in landuse (conversion of wilderness into human settlements or crops), landcover (impervious surfaces) and vegetation (e.g. clear cutting), in addition to widespread channel modification and impoundment (Gregory, 2006) have severely perturbed the amount of sediment that reaches river channels across the globe.

2.1.2. Unsuitability of existing methods for alluvial bed trends

Over longer timescales (10^4–10^6y), net sediment flux and fluvial erosion have been generalised using landscape-evolution models to assess climatic impacts on river incision and drainage network development (Tucker and Slingerland, 1997). These models have provided insight on the long-term impacts of increasing humidity/aridity on channels (Tucker and Slingerland, 1997), but are not appropriate for understanding the short-term responses of alluvial riverbeds to changes in climate, which can be much more transient. Other research has correlated modern records of precipitation or streamflow with vertical (Hartshorn et al., 2002) and lateral (Stark et al., 2010) erosion rates in bedrock rivers, but the spatial and temporal mismatches between precipitation, streamflow, and erosion datasets make it difficult to interpret responses of river systems to climate.

Likewise, concurrent paleo-records of climate and sedimentation (10^3–10^5y) have been employed to provide inferences of past landscape response (Knox, 2000). However, such analyses are complicated by temporal biases in deposited sediments (Jerolmack and Paola, 2010; Sadler, 1981), poorly constrained pre-historical climate records, and feedbacks between riverbed elevation and sedimentation rates (Daniels, 2008).

In the United States, there is excellent documentation for the last several decades of changes in the magnitude and variability of precipitation (Karl et al., 1995), alteration of its timing and form (Knowles et al., 2006), and trends in the frequency of extreme rainfall and associated floods (Groisman et al., 2001). Yet despite decades of precipitation/streamflow measurement, the links between climate and contemporaneous changes in river morphology remain unexplored at broad spatial scales. This shortcoming thwarts short term prediction of the impacts of how climate change may affect flood risk (e.g. ratios of flood stage to floodplain elevation), longitudinal sediment storage, and the spatial distribution and stability of aquatic habitat (e.g. frequency of bed disturbance events and amount of in-channel sediment storage), as well as long-term understanding of drainage basin development (e.g. river longitudinal profile shape).

This chapter examines relationships between riverbed elevation time series, basin characteristics, climate, and climate change, in order to: (i) investigate broad-scale controls on riverbed elevation trends; (ii) assess the variability in this signature across climatic gradients; and (iii) determine how the imprint may be affected by climate changes.

2.2. Methods

2.2.1. Reference stream gages

The Geospatial Attributes of Gages for Evaluating Streamflow (GAGES II) dataset, published in September 2011, is a spatial dataset that collates data for 9,322 stream gages alongside comprehensive geospatial features, including basin characteristics (e.g. precipitation, geology, soils, and topography) and anthropogenic influences (e.g. land use, road density, presence of dams, or canals) (Falcone, 2011). Within the dataset, 2,057 sites are classified as 'Reference' sites, meaning that they are located within watersheds where hydrologic and sediment conditions are least disturbed by human influences. Of these, 1,633 sites have at least 20 years of complete streamflow record since 1950 (through 2009). Reference conditions are defined by a quantitative hydrologic disturbance index (based on the presence of dams, reservoir storage, percentage of artificial streamlines, road density, pollutants, and land fragmentation), local expert judgment from Annual Data Reports, and a qualitative assessment through inspection of every stream gage from high-resolution imagery and digital topographic maps, to identify any visible forms of hydrologic alteration (human activities, agriculture, reservoirs, structures) (Falcone, 2011). One limitation of reference sites is that the watersheds are all smaller than 50,000 km^2. This is because the streamflow of large drainage areas has often been modified at some point in the catchment by human alterations (extractions, channel impoundment, etc.).

USGS manual field channel measurements and daily data were downloaded for all reference gaging stations (Falcone, 2011; U.S. Geological Survey, 2014a) within the continental USA between 1 January 1950 and 31 December 2011.

2.2.2. Stream gage (site) selection

To evaluate temporal changes in a specific channel cross-section, it is imperative that measurements are made in the same cross-section over time. However, stream gages are sometimes moved because of significant anthropogenic or other abrupt changes to stream channel geometry, and stream datum is sometimes adjusted because of extreme scour of the riverbed (Rantz, 1982a; Smelser and Schmidt, 1998). As changes in gage location or datum may affect bed elevation time series, any sites exhibiting such a change were removed. To verify this, all 1,390 sites in the conterminous USA were investigated via annual water-data reports (ADRs), where available. The majority of the reports investigated were dated 2010-2011. From the 1,390 sites investigated, 202 were missing data reports and 255 had experienced a change in the gaging location/datum since 1 January 1950. Conservatively, only sites with stable gage location/datum since 1950 were retained, to ensure consistency.

2.2.3. Filtering of individual manual field measurements

Manual field measurements of the channels were obtained for all reference sites and filtered as follows. Stations not labelled as streams/rivers (e.g. canals, ditches) were removed, as were measurements made in unstable or unfixed locations (more than zero meters from the gage location). Measurements with missing, zero, or negative values for discharge, velocity, gage height, width, or area were deleted. Any outlier values in the data were removed using Tukey's method, which rejects any measurement located more than three interquartile ranges below the 25th percentile or above the 75th percentile. We obtained 915 sites in the continental USA with more than 20 measurements over more than 10 years after data filtering, but most records were much longer (mean values for the entire dataset: 202 measurements over 32.7 years).

2.2.4. Bed elevation calculation

Assuming a rectangular cross section, mean bed elevation was calculated from flow measurements as:

$$z = G - (A / w) \tag{2.1}$$

where z is the bed elevation, G is flow stage (gage height) above local datum, A is flow area, and w is flow width. The ratio of A/w is the average channel depth in the cross-section, and therefore smoothes out any variability in channel bed elevation in the cross-section. Hence, the computed bed elevation is the average bed elevation within the channel cross-section (Figure 2.2).

Non-significant bed elevation trends were classified as bed elevation variability and characterised by the interquartile range of the bed elevation distribution (as indicated by dashed horizontal lines on Figure 2.3a). The approach to estimate bed elevation from the stage, discharge and width observations results in some uncertainties as a function of changing cross sectional shape or roughness. In channels that are not precisely rectangular, the calculated bed elevation will change a little with the gage height, e.g. resulting in slightly higher calculated bed elevations for high flows than for low flows. We found that this bias does not modify the trend direction or magnitude when manual field channel measurements are made over a wide range of flows over time (as is the case). However, researchers should use caution when evaluating change at specific sites of interest.

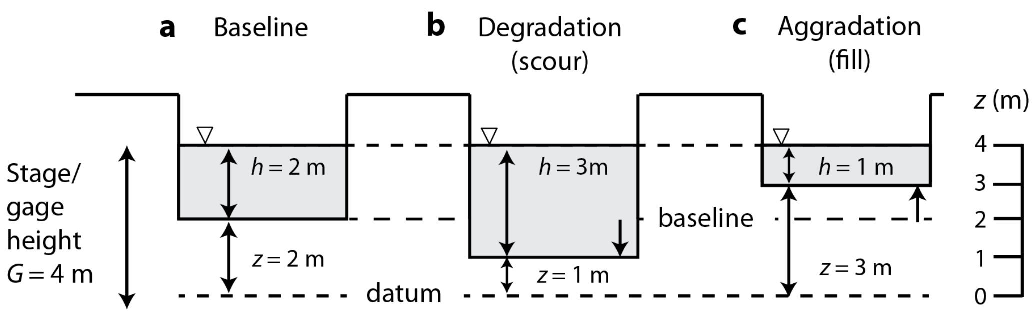


Figure 2.2. Schematic representation of shifts in alluvial bed elevation. Three idealised rectangular cross-sections are presented, representing: (a) a baseline scenario, (b) degradation, and (c) aggradation of the riverbed. In all three scenarios, the water-surface elevation (stage) is of 4 metres. Bed elevation (z) above the channel datum is indicated beneath each cross-section. The depth (h) is indicated within each channel cross-section. Modified after Isaacson and Coonrod (2011).

Bed elevation measurements were used to derive annualised rates of aggradation and degradation as the regression slope of bed elevation over time, and only sites with significant p-values of a two-tailed Spearman's correlation coefficient ($p<0.05$) were retained as bed elevation trends (as indicated by black trend line on Figure 2.3a).

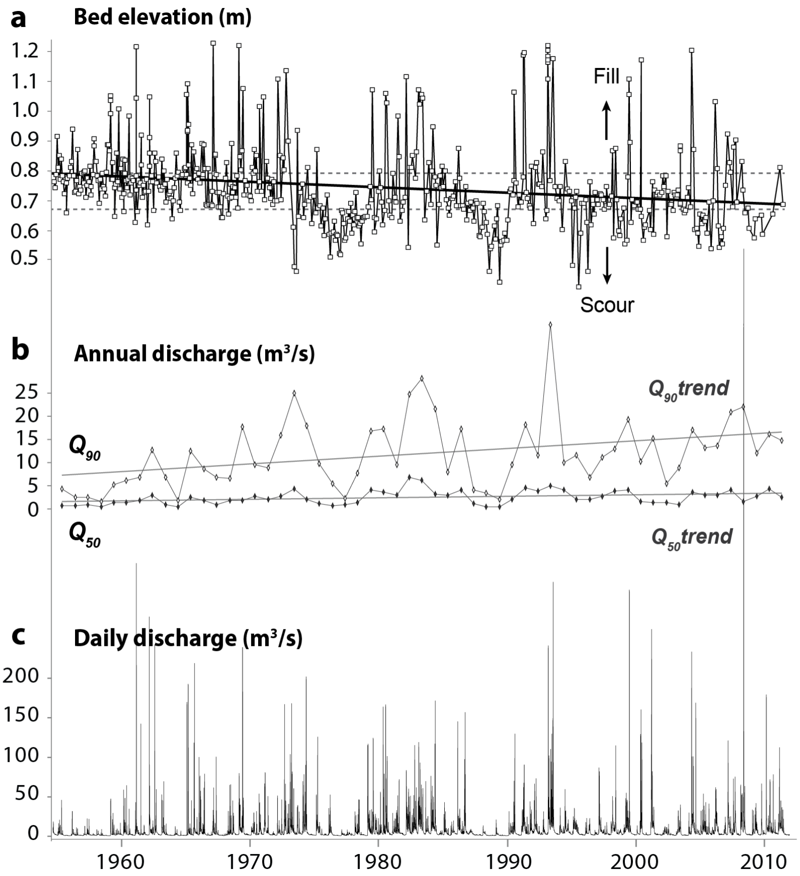


Figure 2.3. Time series at site 05458000: (a) bed elevation (m), (b) annual Q_{50} and Q_{90} (m^3/s), and (c) daily discharge (m^3/s). Dashed horizontal grey lines represent interquartile range of bed elevation, used in calculation of bed elevation variability, and the black line marks the degrading bed elevation trend. Statistics are, for the bed elevation trend: -0.18cm per year, p:$1.42x10^{-18}$. For the Q_{50} trend: +$0.03m^3$ per year, p:$1.41x10^{-03}$. For the Q_{90} trend: +$0.17m^3$ per year, p:$4.21x10^{-04}$.

2.2.5. Streamflow statistics: percentiles, trends, and ratios

Mean daily discharge data were obtained for all selected GAGES II reference sites (Falcone, 2011) from the National Water Information System Web Interface (see http://waterdata.usgs.gov/nwis/) between the dates 1 January 1950 and 31 December 2011, to match bed elevation computed measurements. Data were downloaded only for sites with at least 20 complete years of daily discharge and compiled to create a new dataset. All daily streamflow measurements were verified for missing values. Any values labelled 'Dis' (Data collection discontinued), 'Eqp' (Equipment malfunction) and 'Ssn' (Parameter monitored seasonally) were removed. Values labelled 'Ice' (Ice affected) and 'Dry' (Zero flow) were replaced by the value zero.

For each complete water year, annual discharge percentiles (Q_{90} and Q_{50}, m^3/s) were calculated. We computed the median values of all annual percentiles at each site, as well as a high-flow variability ratio (Q_{90}/Q_{50}). The percentiles were also used to compute time trends, termed *Q_{90}trend* and *Q_{50}trend*, in m^3/s per year. Statistically significant trends in streamflow percentiles were determined using the p-value of a two-tailed Spearman's correlation coefficient ($p<0.05$). Spearman's correlations were preferred over Pearson's correlations, in order to assess monotonic relationships between variables (using the ranks of values) rather than linear relationships. Figure 2.3b illustrates the computed trends in annual discharge percentiles (*Q_{90}trend* and *Q_{50}trend*, m^3/s per year), and Figure 2.3c the raw daily discharge time series.

2.2.6. GAGES II data

The GAGES II dataset provides numerous indicators for environmental characteristics (e.g. precipitation, geology, soils, topography) and anthropogenic influences (e.g. land use, presence of dams) for the 9,322 stream gages in the dataset (Falcone, 2011). Drainage area (km^2) is calculated in the GAGES II dataset as the basin boundaries upstream from each gaging station. Bin thresholds of 100, 500, and 1,000 km^2 were selected to represent the range of data. Some drainage areas differ from the National Water Information System (NWIS) values (see the USGS water data website, http://waterdata.usgs.gov/nwis), but 94% of all drainage areas are within ± 10% of the USGS NWIS values and the GAGES II dataset is considered to have greater accuracy than the USGS measurements of drainage area (Falcone, 2011).

Elevation in meters above sea level (mASL) is measured at the gage location from the 100-meter resolution National Elevation Dataset (http://ned.usgs.gov/). Elevation values were binned using a classification presented in Milliman and Syvitski (1992): high mountain (headwaters at elevations greater than 3000 m), mountain (1000-3000 m), highland (500-1000 m), lowland (100-500 m), and coastal plain (less than 100 m).

Mean annual precipitation (mm) is the mean annual precipitation at the gage location, obtained from the 800-metre Parameter Elevation Regressions on Independent Slopes Model (PRISM) data, for the 30 year period of record 1971-2000. The original data are also available directly from the PRISM group at Oregon State University (PRISM Climate Group, 2014, http://www.prism.oregonstate.edu/). Slope (%) is the mean watershed slope derived from the 100-metre resolution National Elevation Dataset. Drainage density (km/km^2) is the total length of streams per upstream watershed area derived from the National Hydrography Dataset 100k streams (original source is http://www.horizon-systems.com/nhdplus/). Basin relief was calculated as basin elevation maximum minus basin elevation minimum. Basin maxima and minima were calculated from 100-metre National Elevation Dataset.

2.2.7. Precipitation trend

The most recent information on precipitation trends for the USA (between 1 January 1950 and 31 December 2009) was obtained from the high-resolution Climate Research Unit Time Series dataset (CRU TS) version 3.1 (Mitchell and Jones, 2005, http://www.cru.uea.ac.uk/cru/data/hrg/). This dataset provides month-by-month variation in precipitation, based on daily values, over the last century. A spatial map of monthly precipitation trend through time was extracted using the climate explorer of the Royal Netherlands

Meteorological Institute – known as the KNMI Climate Explorer (Van Oldenborgh, 2014, http://climexp.knmi.nl/). The data were projected in North American Datum (NAD) Albers 1983 in ArcGIS and joined spatially with the selected reference USGS gaging station sites. Precipitation trends were annualised in millimetres per year. Equal-width bins of precipitation trend were selected to accommodate a similar number of gaging stations in each bin.

2.2.8. Lithology

Using the USGS state-based geological dataset (U.S. Geological Survey, 2014b), lithologies were determined for each USGS gaging station by extracting in a Geographic Information System all the lithologies in the upstream drainage area contributing to each specific reference site (as defined in the GAGES II report). From these data, the dominant lithology, representing the greatest percentage area of upstream drainage area, was selected at each site. Since classification of lithology can vary by state, lithologies were grouped into six broad categories – unconsolidated sediment, clastic sedimentary rocks, carbonate rocks, volcanics, metamorphics and plutonics - based on their assumed erodibility and degree of consolidation (Table 2.1).

Table 2.1. Grouping of lithology into 6 broad classes[1]

Class	Lithologies
Unconsolidated sediment	alluvial fan, alluvial terrace, alluvium, beach sand, calcarenite, clay or mud, coarse-grained mixed clastic, delta, dune sand, eolian, fine-grained mixed clastic, floodplain, glacial drift, glaciolacustrine, gravel, lake or marine deposit, landslide, loess, mixed clastic/volcanic, moraine, outwash, sand, silt, stratified glacial sediment, terrace, till, unconsolidated deposit, volcanic ash.
Clastic sedimentary rocks	arenite, argillite, arkose, black shale, breccia, clastic, claystone, conglomerate, graywacke, medium-grained mixed clastic, melange, mixed clastic/carbonate, mudstone, orthoquartzite, sandstone,

[1] Orthoquartzite, granulite, gneiss, granitic gneiss and orthogneiss should have been categorised as metamorphic but were not at the time the analysis was conducted.

Class	Lithologies
	sedimentary breccia, sedimentary rock, shale, siltstone, phyllonite, tectonic breccia, tectonite.
Carbonate rocks	carbonate, dolostone (dolomite), limestone, evaporate.
Volcanics	alkaline basalt, andesite, ash-flow tuff, basalt, bimodal suite, chert, dacite, felsic volcanic rock, ignimbrite, intermediate volcanic rock, iron formation, latite, lava flow, novaculite, phonolite, pyroclastic, quartz latite, rhyodacite, rhyolite, tephrite (basanite), tholeiite, trachyandesite, trachyte, tuff, ultramafitite (komatite), volcanic rock (aphanitic).
Metamorphics	amphibole schist, amphibolite, augen gneiss, biotite schist, blueschist, calc-silicate rock, felsic metavolcanic rock, greenschist, greenstone, hornfels, intermediate metavolcanic rock, mafic gneiss, mafic metavolcanic rock, mafic volcanic rock, marble, meta-argillite, meta-basalt, meta-conglomerate, metamorphic rock, meta-rhyolite, metasedimentary rock, metavolcanic rock, mica schist, paragneiss, pelitic schist, phllite, quartzite, quartz-feldspar schist, schist, sepentinite, slate, mylonite.
Plutonics	migmatite, alkali syenite, alkali intrusive rock, alkali-granite (alaskite), anorthosite, biotite gneiss, diabase, diorite, dunite, felsic gneiss, gabbro, gabbroid, gneiss, granite, granitic gneiss, granitoid, granodiorite, granofels, monzonite, norite, pegmatite, peraluminous granite, peridotite, plutonic rock (phaneritic), pyroxenite, quartz diorite, quartz monzodiorite, quartz monzonite, quartz syenite, syenite, tonalite, trondhjemite, ultramafic intrusive rock, ultramafic rock, orthogneiss, granulite.

2.2.9. Correlations between variables

Bed elevation trend and bed elevation variability were assessed with respect to Q_{90}, Q_{50}, $Q_{90}trend$, $Q_{50}trend$, high-flow variability (Q_{90}/Q_{50}), mean annual basin precipitation (mm), significant ($p<0.05$) annualised trend in mean precipitation (mm per year) (Mitchell and Jones, 2005), as well as the drainage basin characteristics which are generally assumed to control river incision, including drainage area (km^2), site elevation (mASL), mean watershed slope (%), drainage density (km/km^2), and dominant basin lithology. Our identification of relationships between bed elevation trends, variability and other variables employs the median of all site values within each distribution.

2.3. Results and discussion

Decadal trends of bed elevation change were found at 623 (68%) sites across the conterminous USA. Of these, 239 (26%) sites are aggrading and 384 (42%) are degrading (Table 2.2). Average rates are of +0.5/-0.6 centimetres per year over a period of 34 years (Table 2.2), thus much higher than millennial-scale basin-averaged erosion (Kirchner et al., 2001; Kober et al., 2007; Summerfield and Hulton, 1994) or sedimentation (Sadler, 1981) rates, which are typically in the range of several centimetres per thousand years, though they can be highly variable. This discrepancy between contemporary rates of change and those observed over millennia is largely due to the discontinuous nature of the net sedimentation process (Sadler, 1999, 1981), so short-term (e.g. decadal) sediment erosion/deposition rates typically display an inverse relationship with the time span over which they are calculated.

Table 2.2. Bed elevation trend and variability - summary statistics

	Aggradation (cm y^{-1})	*Degradation* (cm y^{-1})	*Bed elevation variability* (m)
N (number of stations)	239	384	292
Median	0.5	-0.6	0.1
Percentile 25	0.2	-1.2	0.1
Percentile 75	1.0	-0.3	0.2
% of N	26.1	42.0	31.9
Mean # of years of bed elevation measurements at each site	34.4	34.1	29.5
Mean # of bed elevation measurements	234	212	163

Figure 2.4 and Figure 2.5 reveal a broad mix of bed elevation trend and variability sites across the continental USA, with no obvious systematic geographic biases. There are local concentrations of aggrading (Pacific Northwest) and degrading (Appalachia) stations within similar mean annual precipitation regimes, but these also occur in regions that have had contrasting trends in mean annual precipitation (Groisman et al., 2001).

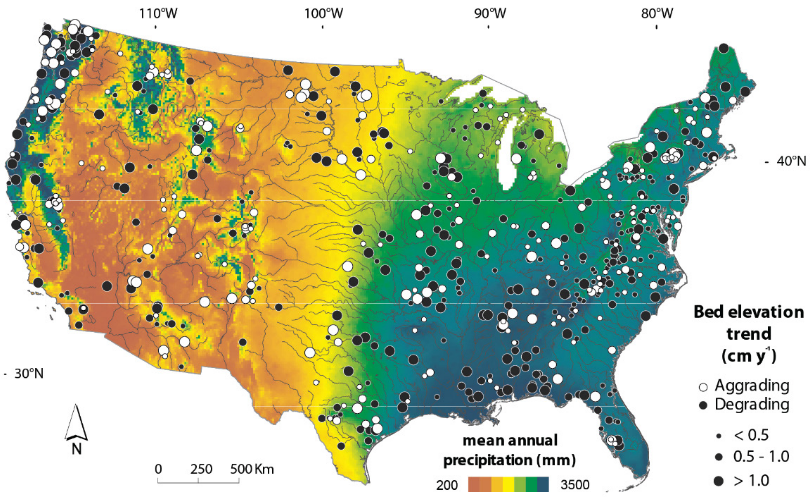


Figure 2.4. Map of bed elevation trend against background of mean annual precipitation values.

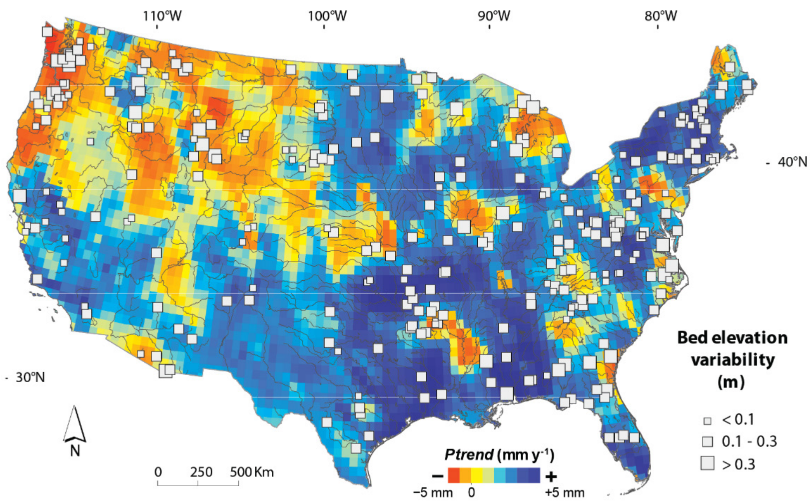


Figure 2.5. Map of bed elevation variability against background of precipitation trend values.

Bed elevation time series (Figure 2.3) reveal that high-frequency fluctuations in riverbed level are typically caused by short-term variability in local hydrology (which are expressed as bed elevation variability at otherwise stable sites, Figure 2.5). The bed elevation appears to correlate with discharge, so that over decadal time scales bed elevation trends capture systemic shifts in climate and/or sediment supply (e.g. decreasing bed elevation, concomitant with an upward shift in Q_{50} and Q_{90}, Figure 2.3).

These factors suggest that changes in bed elevation may be intrinsically linked to spatial and temporal differences in the frequency of sediment-transporting events expressed between climatic regions (Baker, 1977; Knowles et al., 2006; Molnar et al., 2006; Tucker and Bras, 2000). For example, geomorphically effective flows and associated sediment may be generated within a small proportion of the drainage area (Kochel, 1988; O'Connor, 2004; Tucker and Slingerland, 1997), thereby affecting only local rates of bed elevation change (Baker, 1977) or redistributing sediment (Kochel, 1988).

2.3.1. Drainage basin controls

Models of long-term landscape evolution often assume constant basinwide sediment supply, so stream power (essentially the product of discharge and the channel gradient) controls rates of bed elevation change (Sklar and Dietrich, 1998; Whipple and Tucker, 1999) and further, streamflow scales with drainage area. We found that none of the following variables correlates with magnitude of bed elevation trends or variability: mean watershed slope, drainage density, basin relief, gage elevation, mean annual precipitation, or basin lithology (Figure 2.6), suggesting that that decadal rates of erosion/deposition may be unrelated to the processes controlling long-term rates of erosion and sedimentation.

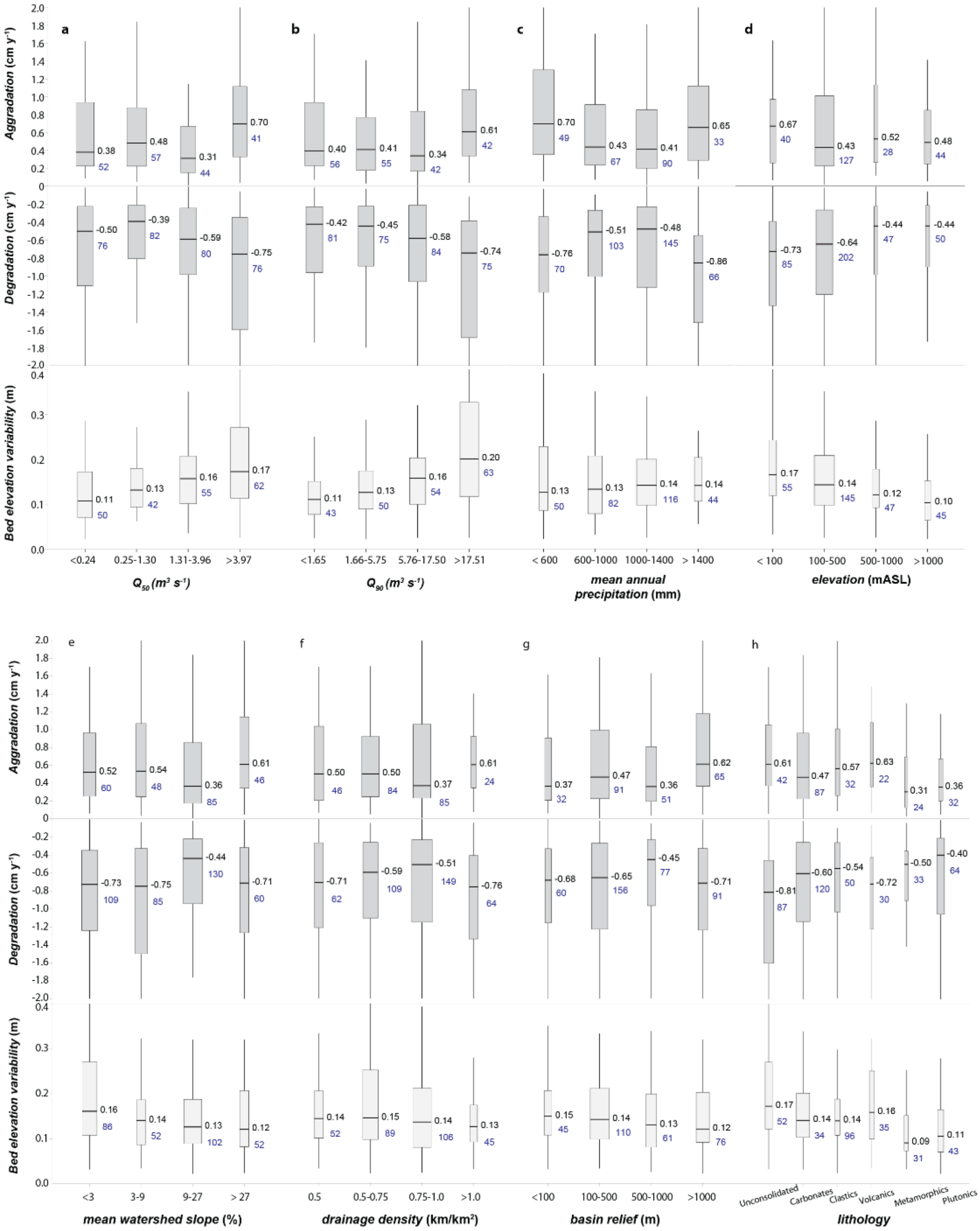


Figure 2.6. Annual bed elevation trends: aggradation (cm y^{-1}), degradation (cm y^{-1}) and bed elevation variability (m) versus the following variables: (a) median Q_{50} (m^3 s^{-1}), (b) median Q_{90} (m^3 s^{-1}), (c) mean annual precipitation (mm), (d) elevation (mASL), (e) mean watershed slope (%), (f) drainage density (km/km^2), (g) basin relief (m), (h) lithology. Values in black to the right of each horizontal black line indicate distribution

median. Mean number of measurements per site was 220 for positive and negative bed elevation trends and 163 for bed elevation variability sites; with 34 years and 30 years of data respectively. Overall, decadal median values are +0.5 cm per year for aggradation and −0.6 cm per year for degradation, which are considerably higher than most documented long-term, basin-averaged rates of erosion in mountain belts and short-term rates derived from suspended sediment yields (Kirchner et al., 2001).

However, our results do show that the absolute magnitude (not direction) of positive and negative decadal bed elevation trends and bed elevation variability are correlated with Q_{50} and Q_{90} (Figure 2.6) and drainage area (Figure 2.7, Figure 2.8), indicating a positive first-order relationship between the magnitude of bed elevation change and variability and the volume of erodible alluvial fill (and thus scour depth) in progressively larger basins, regardless of network structure, basin physiography, runoff generating mechanisms, or geologic materials.

Thus, absolute decadal riverbed fluctuation rates may be more closely related to the magnitude of stochastic processes with which water and sediment are supplied to the channels (e.g. the volume of floods capable of flushing out the sediment that is stored in valley sinks, such as tributary junctions and floodplains (Thompson et al., 2011)) rather than to the long-term processes that control basin-scale erosion rates. These findings are consistent with short term erosion rates measured in the eastern Central Range in Taiwan (in the range of 0.2 to 0.8 centimetres per year – similar to ours), which did not reflect lithology, tectonic environment or climate either (Fuller et al., 2003).

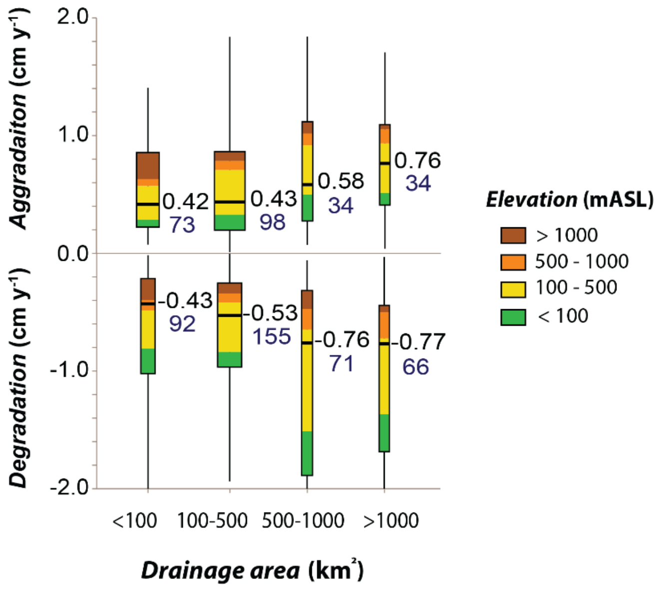


Figure 2.7. Boxplots show aggradation and degradation rates ($p<0.05$) for different categories of drainage area. Boxes, depicting distributional interquartile range, are variable-width based on number of stations in each bin (blue text below the medians). Colour stripes indicate proportionality of sites within different variable categories.

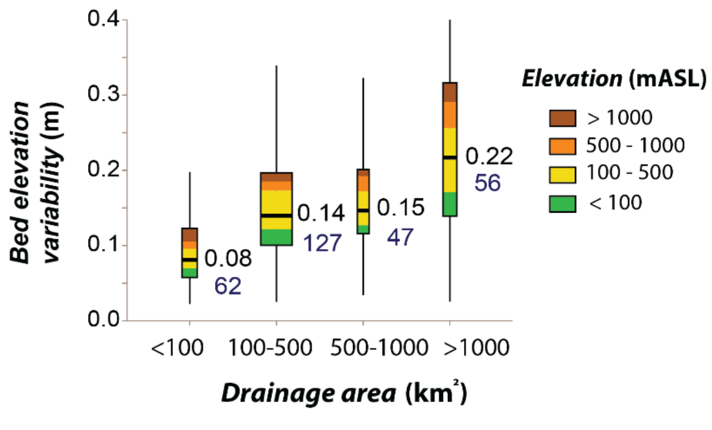


Figure 2.8. Bed elevation variability for different categories of drainage area. Same symbology for boxes as Figure 2.6. Mean number of bed elevation variability measurements per site was 163 (30 years of data).

2.3.2. The imprint of climate

2.3.2.1. High flow variability, a measure of geomorphic effectiveness

Wolman and Miller (1960) first quantified 'geomorphic work' as the amount of suspended sediment that a flood could transport, so an 'effective' flood is one that has the ability to alter the landscape durably, and the most effective events are considered to be those of moderate frequency such as the bankfull flood (Wolman and Gerson, 1978). However, the question of which discharges are the most effective in shaping channels in different climates remains largely unresolved. In the Powder River, Montana, Pizzuto (1994) found that the channel only expands in years with the highest discharge, and that channel form varies as a function of variability in the annual maximum daily discharge. Thus, if large floods are responsible for most of the geomorphic work, one may question whether rates of bed elevation change are related to the magnitude of streamflow variability (i.e. the relative size of large floods above median flows).

Building on prior work (Molnar et al., 2006; Pitlick, 1994; Tucker and Slingerland, 1997), we investigate the hypothesis that sequences of flood events capable of inducing long-term change in riverbed elevation are largely a function of regionally determined precipitation variability (Tucker and Bras, 2000) and its expression in streamflow distributions. Climatically, this should be expressed in streamflow distributions as a ratio between high and mean flows (chapter 1). Thus, we computed Q_{90}/Q_{50}, or high flow variability, as a proxy for riverbed shear-stress distribution, i.e. the magnitude of flood peaks that are likely to transport bed sediment, above the sediment transport threshold (Baker, 1977; Molnar et al., 2006; Pickup and Warner, 1976). To evaluate the role of the magnitude of high flows *versus* median flows, we truncated the distribution at Q_{90} in order to minimise the influence of extremely rare floods, and normalised positive and negative bed elevation trends by the median depth from all manual field channel measurements for each site, in order to investigate the secular effects of climatic expression in streamflow in a scale-independent way. We consider this high-flow variability as a measure of geomorphic effectiveness.

Monotonically increasing relationships were found between depth-normalised rates of aggradation/degradation and Q_{90}/Q_{50} (Figure 2.9), consistent with the idea that high-flow variability controls sediment flux and morphologic change (Molnar et al., 2006; Tucker and Slingerland, 1997). Bed-material flux occurs in the middle of the streamflow distribution (sub-bankfull, depending on climatic regime) as transport of the active sediment layer (Emmett and Wolman, 2001), and on the high end of the streamflow distribution as reshaping of the channel (Pickup and Warner, 1976; Powell et al., 2006).

The most effective floods are those that occur when an optimal combination of peak flood power per unit area, duration, and energy expenditure is attained (Costa and O'Connor, 1995). Therefore, one may assume that stations with higher values of Q_{90}/Q_{50} are prone to more frequent channel scour/fill, subject to constraints of an erodible riverbed, leading to greater potential for bed elevation trends. Stations with high Q_{90}/Q_{50} and with positive Q_{90}/Q_{50} trends may thus be expected to have greater potential for bed elevation trends.

2.3.2.2. Expression of high flow variability in different climates

Although the relationship between rates of aggradation/degradation and mean annual precipitation is poorly defined (Figure 2.6), we found that mean annual precipitation has an indirect influence on rates of bed elevation change. High-flow variability (Q_{90}/Q_{50}), which is directly correlated with positive and negative bed elevation trends (Figure 2.9), is inversely proportional to mean annual precipitation (i.e. Q_{90}/Q_{50} decreases systematically with increasing mean annual precipitation) (Figure 2.10), highlighting the variable expression of climate in streamflow distributions.

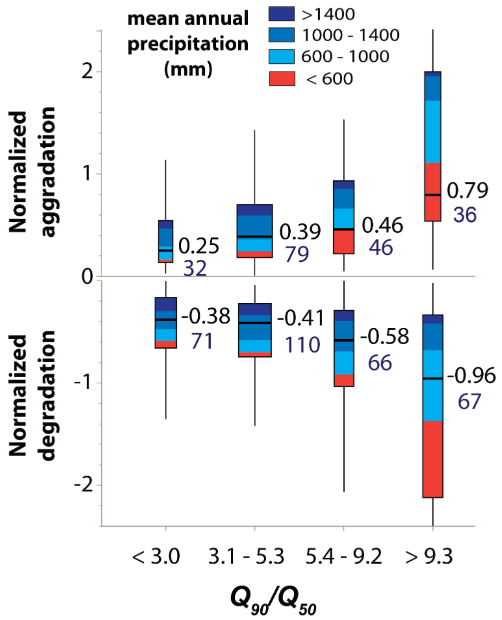


Figure 2.9. Bed elevation trends normalised by the median flow depth from all manual field channel measurements at each site versus high-flow variability ratio (Q_{90}/Q_{50}). Symbology same as in Figure 2.6.

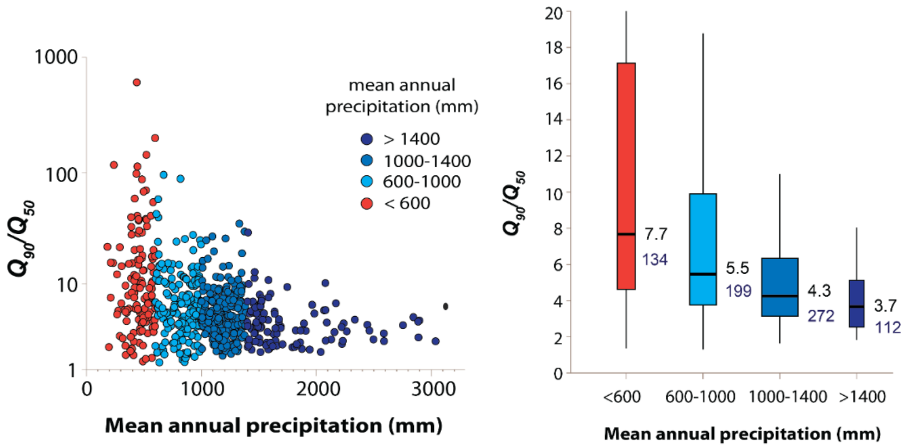


Figure 2.10. High flow variability, Q_{90}/Q_{50}, versus mean annual precipitation (mm).

We find that dry regions have higher Q_{90} for the same Q_{50} than wet regions, consistent with prior work (Molnar, 2001; Turcotte and Greene, 1993). The difference in flow variability distributions between wet and arid regions is due to the more frequent occurrence of large floods per smaller flood in arid regions compared to humid regions, because of the higher runoff coefficients in arid regions. This can be visualised as steeper flow frequency growth curves in arid regions compared to humid regions (Farquharson et al., 1992; Zaman et al., 2012).

In dry regions, high rates of bed elevation change are associated with high flow peaks (Q_{90}/Q_{50} ratios that are generally greater than 10) above relatively low median flows (Q_{50} of generally less than 1 m^3/s), so large floods dramatically scour the landscape. In particular, we found an overrepresentation of high rates of positive and negative bed elevation trends at dry sites with the highest values of Q_{90}/Q_{50} (Figure 2.9). However, even moderate flows may be capable of transporting bed sediment in arid regions due to a lack of armouring (Laronne et al., 1994) and sparse vegetation.

In wet regions, bed elevation change occurs at sites with higher median flows (Q_{50} typically greater than about 10 m^3/s) and low flow variability (Q_{90}/Q_{50} ratios generally smaller than about 5), although there are both high and low geomorphically effective flows in some basins (Pickup and Warner, 1976). Even though Q_{90}/Q_{50} is typically lower than in dry sites, Q_{50} is apparently sufficiently high above the threshold for sediment flux at these sites to enable high values of change (Figure 2.6).

These factors suggest, in general, that bed elevation change in arid regions is probably dominated geomorphically by infrequent channel-shaping flood events – which are the only flows large enough to perform geomorphic work (Baker, 1977) – rather than frequent transport of the active layer that prevails in wetter regions (Pickup and Warner, 1976).

2.3.3. The impacts of changes in climate

Given the monotonic relationships between Q_{90}/Q_{50} and rates of bed elevation change (Figure 2.9), and the corresponding inverse relationship between Q_{90}/Q_{50} and mean annual precipitation (Figure 2.10), we question the potential impact of observed changes in precipitation and streamflow on bed elevation trends and variability. To remove any scale bias we computed percentage changes in streamflow, and found significant streamflow trends at 26% of sites for which sufficient data exist (n=187), which reflect documented precipitation trends for the contributing watersheds (Mitchell and Jones, 2005).

2.3.3.1. Precipitation trend and streamflow trend

Streamflow trends (both Q_{50} and Q_{90}) increase with precipitation trend up to 2 mm per year, and negative precipitation trends are associated with concomitant declining trends in both streamflow percentiles (Figure 2.11). We also found that moderately positive precipitation trends (1-2 mm per year) are disproportionately expressed as increasing streamflow trends in relatively dry watersheds, or those with high values of Q_{90}/Q_{50}. However, the highest precipitation trends (greater than 2 mm per year) are not associated with the highest streamflow trends (Figure 2.11), suggesting there is asymptotic buffering of extreme changes in rainfall in wet basins (e.g. via floodplain storage), or that vegetation growth suppresses increases in runoff in wet regions (Collins and Bras, 2010).

The non-monotonic nature of the relationship between precipitation trend and streamflow trend is thus likely due to differences in the manner in which precipitation translates to streamflow in different climates, with a greater proportion of precipitation being absorbed in regions with high vegetation cover and low runoff coefficients (Collins and Bras, 2010).

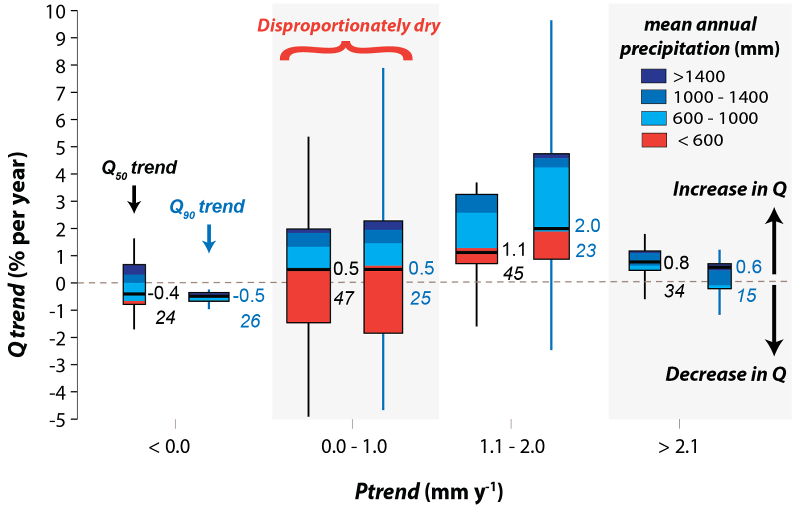


Figure 2.11. Streamflow trend versus precipitation trend. Annual percentage change in Q_{50}trend and Q_{90}trend normalised by the median value of streamflow for each site versus precipitation trend. Within each x-axis category, Q_{50}trend is represented by the left box and Q_{90}trend is presented in the right box. Symbology is the same as in Figure 2.6. We found a similar number of sites with increasing/decreasing Q_{90}trends (n = 47:42), but twice as many sites with increasing Q_{50}trend (n = 103:49).

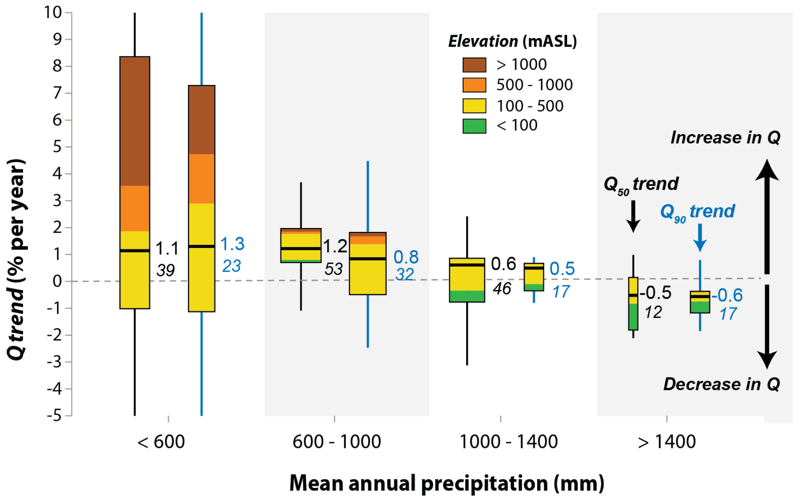


Figure 2.12. Streamflow trend versus mean annual precipitation. Annual percentage change in Q_{50}trend and Q_{90}trend normalised by the median value of discharge for each

site versus mean annual precipitation. As in Figure 2.11, within each x-axis category, Q_{50}trend is represented by the left box and Q_{90}trend is presented in the right box. Symbology is the same as in Figure 2.6. We found a similar number of sites with increasing/decreasing Q_{90}trends (n = 47:42), but twice as many sites with increasing Q_{50}trend (n = 103:49).

2.3.3.2. Streamflow trend and mean annual precipitation

Significant trends in both streamflow percentiles (*Q_{50}trend* and *Q_{90}trend*) are inversely related to mean annual precipitation, such that streamflow trend strength progressively declines in increasingly wet watersheds (Figure 2.12). This translates as an overall increase in streamflow in dry regions (medians of 1.1 % and 1.3 % per year for *Q_{50}trend* and *Q_{90}trend*, respectively, for sites with mean annual precipitation less than 600 mm), and a modest decrease at the wettest locations (median −0.5 % and −0.6 %, respectively for those with mean annual precipitation greater than 1400 mm), in comparison with the overall median value of streamflow trend (either Q_{50} or Q_{90}) across all climates of approximately +0.7% per year.

However, decreases in Q_{50} are also disproportionately expressed at dry sites and at high elevation (greater than 1000 mASL), and decreases in Q_{90} prevail disproportionately at wet sites (greater than 1400 mm) (Figure 2.13). These disproportionate results suggest the complexity of climate change expression in streamflow.

2.3.3.3. Streamflow trends and bed elevation

How may such streamflow trends impact bed elevation? Because the datasets are concurrent, it is challenging to discern cause from effect, especially if bed elevation response lags the climate change. However, we found that significant ($p<0.05$) trends in both streamflow and bed elevation occurred at 18% of sites with discharge data, and that marked increases and decreases in Q_{50} and Q_{90}

(greater than +1% and less than −1%) were both associated with higher rates of bed elevation change (Table 2.4, Figure 2.13).

(i) Humidification

Climatic humidification in both dry and wet climates is expressed through increasing trends in both Q_{50} and/or Q_{90} (increases greater than +1%; Q_{50}*trends* are more common, see Figure 2.13). The upward shift in median streamflow, which is typically greater than the increase in Q_{90}, is consistent with decreasing Q_{90}/Q_{50}. This increases the flow duration above a fixed sediment flux threshold, potentially rendering the flow regime more geomorphically effective, regardless of small contractions in flow variability.

These data suggest that humidification is most prominently expressed in dry regions as elevated median streamflow with fewer and smaller rises in Q_{90}, but this result may be an artefact of the measurement timescale, since larger floods occur less frequently and it thus takes longer for significant trends to develop in such higher flow percentiles (indeed arid environments may not receive a large flood in most years).

(ii) Aridification

Aridification, observed through decreased Q_{50} at half as many sites as humidification (number of sites = 49:103), is typically expressed through declines in Q_{90}, yet expansion of Q_{90}/Q_{50} in dry and wet regions, and corresponds to high rates of bed elevation change.

What may explain the relationship between climatic aridification and high rates of bed elevation change (Figure 2.13)? At wet sites, one would expect aridification to reduce the already high number of sediment flux days (with geomorphically effective flow), yet a small change is unlikely to have a major impact on bed elevation trends and variability, unless a transport/storage threshold is crossed. At arid sites it is plausible that changes in the flood frequency-magnitude relationship, especially in Q_{90}, may affect bed elevation change over much longer timescales, since bed elevation is essentially a function of larger and less frequent channel-shaping floods.

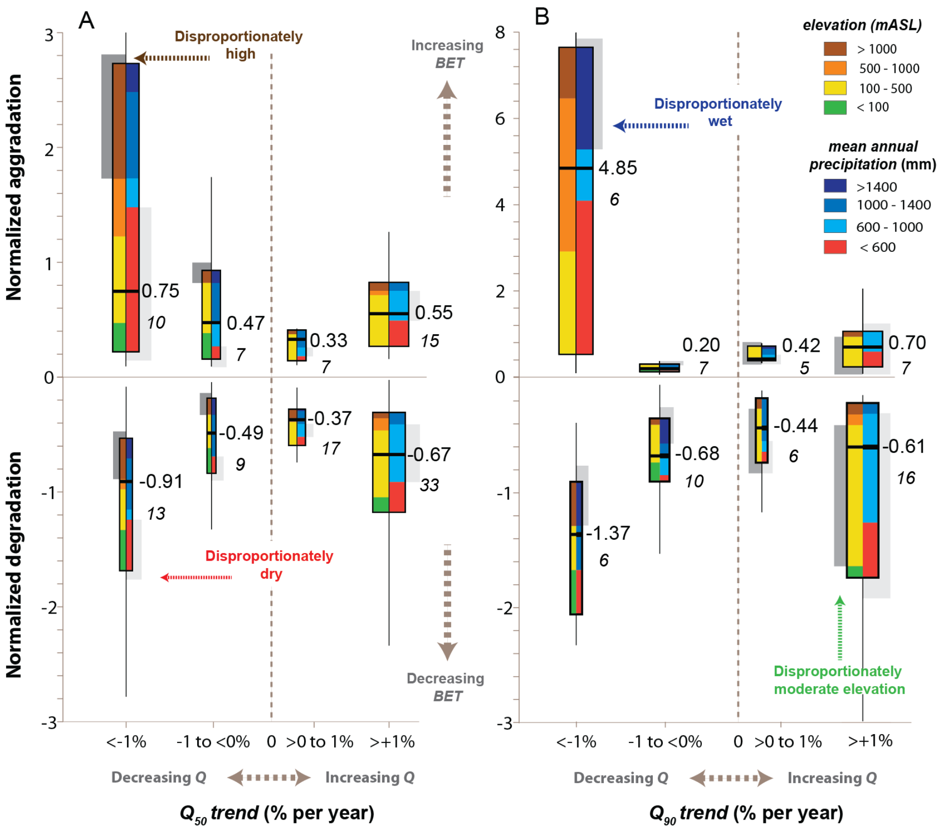


Figure 2.13. Bed elevation trend normalised by the median flow depth from all manual field channel measurements at each site (cm.y/depth) versus Q_{50}trend normalised by the median value of discharge for each site (% per year) (A), and Q_{90}trend normalised by the median value of discharge for each site (% per year) (B). Symbology is the same as in Figure 2.6. Grey boxes indicate disproportionate representation of particular categories within each bin in comparison to the total distribution (i.e. ≥50% more sites within a particular category of meanP or elevation in a Qtrend bin than in the entire distribution of analysed stations). Shades of grey are consistent for similar overrepresentation in other bins. Depicted overrepresentation for Aggradation is the same as for Degradation. Note: Scale for Q_{90}trend aggradation is different than for Q_{50}trend aggradation.

However, it is also possible that lower median flows develop concomitantly with increased values of extreme flows that occur less frequently than the annual measure (*Q_{90}*) analysed in this chapter, and which are capable of reshaping the river channel and producing steeper trends in bed elevation. Further work is required to clarify this effect.

2.4. Conclusions

This chapter documents climatically influenced bed elevation trends and variability across the continental United States. We demonstrate that streamflow variability varies by climatic regime proportional to bed elevation change. The results can be summarised as follows. (1) We found nonstationarity in bed elevation at most sites: 68% of stations have significant ($p<0.05$) trends (median values = +0.5cm per year, aggradation; –0.6cm per year, degradation) with no obvious geographical expression or control through drainage basin structure, physiography, or materials. (2) Raw rates of bed elevation change are scale-dependent (e.g. higher in larger basins). (3) High-flow variability (Q_{90}/Q_{50}), a measure of geomorphic effectiveness, translates directly into the magnitude – though not the direction – of bed elevation change, after removing the scale dependence. (4) Q_{90}/Q_{50} declines systematically from dry to wet climates, producing disproportionately high rates of bed elevation change in drier regions. (5) The largest increases in precipitation and streamflow occurred disproportionately at dry sites, and correlate with decreasing Q_{90}/Q_{50}, while streamflow declined disproportionately at wet sites, concomitant with Q_{90}/Q_{50} increase. Thus, climate change, by affecting the variability in high streamflows in contrasting climates, may act to redistribute the prevailing signature of climate in alluvial riverbeds.

This chapter highlights the potential implications of changes in riverbed elevation for flood hazard, sediment budgets, aquatic habitat, and for the stability of infrastructure. However, the effects of changes in channel geometry on flood hazard have never been dissociated from the effects of changes in the flow-frequency distribution. Thus, in chapter 3, we focus on disentangling these two major drivers of flood hazard and compare the effects of channel capacity *versus* flow frequency across the United States.

Table 2.3. Statistical significance of relationships between variables presented in the figures of chapter 2

		Boxplots Kruskal-Wallis significant differences in bed elevation trend / variability medians between bins*		Scatter plots of same variables (not presented) Spearman's ρ significance of linear regression†		
		Chi-Square	sig.	ρ	p-value	N
Figure 2.7	*Aggradation*	8.6	3.51×10^{-02}	0.185	4.012×10^{-03}	239
	Degradation	18.8	3.02×10^{-04}	-0.227	7.169×10^{-06}	384
Figure 2.8	*Variability*	59.1	8.99×10^{-13}	0.428	1.820×10^{-14}	292
Figure 2.9	*Aggradation*	25.9	9.80×10^{-06}	0.289	4.676×10^{-05}	193
	Degradation	24.6	1.91×10^{-05}	-0.273	8.646×10^{-07}	314
Figure 2.10	Q_{90}/Q_{50}	81.2	1.69×10^{-17}	-0.320	1.759×10^{-18}	717
Figure 2.11	$Q_{50}trend$	17.250	6.28×10^{-04}	0.203	1.27×10^{-02}	150
	$Q_{90}trend$	21.790	7.21×10^{-05}	0.314	2.73×10^{-03}	89
Figure 2.12	$Q_{50}trend$	22.648	4.78×10^{-05}	-0.263	1.17×10^{-03}	150
	$Q_{90}trend$	11.831	7.99×10^{-03}	-0.233	2.82×10^{-02}	89

*H-test statistic (Chi-square) and p-value (sig.) for the Kruskal-Wallis H-test, for each panel, across each group of four boxes.

† Spearman's correlation coefficient (ρ), significance (p-value), and count (N), for the linear regression between the two variables displayed in each panel.

Table 2.4. Bed elevation trend medians for different streamflow trend bins (Figure 2.13)

		Aggradation (cm y^{-1})		*Degradation* (cm y^{-1})	
		Median	N	Median	N
Q_{50}*trend*	< -1%	0.7	10	-0.9	13
	-1 to 0%	0.5	7	-0.5	9
	0 to 1%	0.3	7	-0.4	17
	>+1%	0.6	15	-0.7	33
Q_{90}*trend*	< -1%	4.9	6	-1.4	6
	-1 to 0%	0.2	7	-0.7	10
	0 to 1%	0.4	5	-0.4	6
	>+1%	0.7	7	-0.6	16

3. Chapter 3. Hydrologic and geomorphic drivers of changing flood hazards

3.1. Introduction

Freshwater flooding is a major hazard to lives and infrastructure, but trends in flood hazard are poorly understood. Economic losses due to flooding have increased dramatically over recent decades, and flood hazards (the probability of high river flows exceeding flood stage) are expected to grow in many regions as climate change accelerates the hydrologic cycle (Field et al., 2012; Kundzewicz et al., 2014). In the USA, direct flood losses from 1980 to 2010 averaged $7.8B/y, and the National Flood Insurance Program proposed raising insurance premiums to reflect the 'true flood risk' (Biggert-Waters Flood Insurance Reform Act, 2012; King, 2013). For planning and insurance purposes, flood hazard based on historical flood records is typically assumed to be statistically stationary, raising the question of how flood hazard may change over time and what drives those changes. However, there is evidence that changes in climate and land cover are altering river flows (Kundzewicz et al., 2014), and that changes in stream channel cross sections are altering local channel capacity (Stover and Montgomery, 2001; Lane et al., 2007). This raises important questions of how flood hazard may change over time and what drives those changes.

3.1.1. Factors that affect flood hazard frequency

Freshwater flooding occurs wherever river discharge from the upstream basin exceeds local channel capacity at flood stage, i.e. the volume of flow that can be carried within the channel cross section per unit time (U.S. Water Resources Council Hydrology Committee, 1981). Thus, the frequency with which flooding occurs depends on two factors: the capacity of the local channel cross section to carry the flow delivered from upstream (the channel capacity), and the frequency distribution of flows generated from the upstream basin. Flood hazard can therefore be amplified either by an increase in the frequency of high flows (Merz et al., 2012), or by a reduction in channel capacity (Stover and Montgomery, 2001) (Figure 3.1).

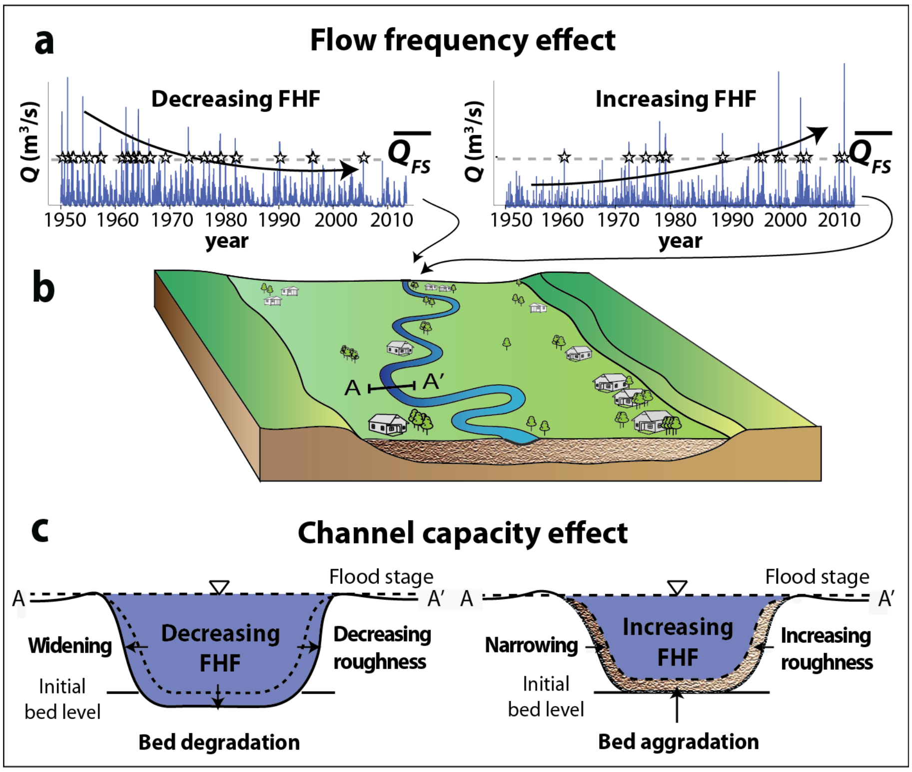


Figure 3.1. Schematic of flow frequency and channel capacity effects on flood hazard frequency (FHF). (a) Time series showing decreasing and increasing flow frequency effects on flood hazard frequency (days equalling or exceeding $\overline{Q_{FS}}$ each year indicated by a star). (b) Flood hazard frequency at channel floodplain cross section A—A' may change due to the flow frequency effect (a) and/or the channel capacity effect (c). (c) Changes in channel capacity alter flood hazard frequency at cross section A—A' through shifts in cross-sectional flow area and/or roughness.

Flow frequency distributions may change in response to: (i) climatic changes (Wilby et al., 2008; Field et al., 2012; Kundzewicz et al., 2014) that affect phase, intensity, duration, and timing of precipitation, snowmelt, or runoff; (ii) anthropogenic modifications of basin water delivery, e.g. damming, upstream extraction, diversions, regulation; and/or (iii) changes in land cover such as agricultural conversion, deforestation or urbanization that affect runoff generation (Blöschl et al., 2007). Trends in flow frequency may affect flood hazard frequency at a cross section even under stable conditions of channel capacity.

Channel capacity, on the other hand, may change due to (i) shifts in cross-sectional channel area at flood stage (sediment infilling or evacuation), caused by bed aggradation/degradation (Slater and Singer, 2013; Stover and Montgomery, 2001), narrowing/widening of the riverbanks; or (ii) changes in the cross-sectional average flow velocity associated with changes in bed sediment texture (Singer, 2010) and/or in-channel vegetation (Friedman and Auble, 2000; Rutherfurd et al., 2006). Both flow area and velocity can also be affected by climatic variability, anthropogenic flow alterations, and/or landscape changes that modify the balance between sediment erosion and deposition in the channel. Reductions in channel capacity amplify flood hazards, even if the flow frequency distribution does not change (Blench, 1969; James, 1999; Stover and Montgomery, 2001; Pinter et al., 2006a; Lane et al., 2007).

3.1.2. Quantifying flood hazard frequency trends accurately

In flood risk analysis and channel design engineering, channel capacity has generally been assumed to be constant over management timescales (U.S. Water Resources Council Hydrology Committee, 1981; Horritt and Bates, 2002; Wilby et al., 2008), and trends in flood frequency have been assumed to be driven primarily by changes in streamflow (Douglas et al., 2000; McCabe and Wolock, 2002; Lins and Slack, 2005; Villarini et al., 2009; Villarini and Smith, 2010). Previous studies have used an approach termed 'specific gage analysis' to infer the effects of changing channel capacity on flood hazard by observing the trend in stage (water level) associated with a reference discharge over time (e.g., Pinter et al., 2006). Although specific gage analysis provides an indication of how channel capacity is shifting, it does not allow river managers to quantify the effects of geomorphic change on flood hazard. Thus, until now, it has not been possible to separate trends in channel capacity from trends in the frequency of high flows, and to compare their effects on flood hazard frequency over decadal and continental scales. This chapter presents novel methods for measuring long-term trends in channel capacity of gaged rivers, and for quantifying how they affect flood frequency. These methods are applied to 401 U.S. rivers in order to quantify the relative contributions of channel capacity and flow frequency to historical flood hazard and to assess how they interact.

3.2. Methods

3.2.1. Background

Cross-sectional discharge (Q) – or the volume of flow (m^3/s) that is carried in a river channel at any given level of stage (the water surface level, noted as gage height G) – is computed as:

$$Q = AU \tag{3.1.a}$$

where A is measured cross-sectional channel area (m^2) and U is measured cross-sectional average flow velocity (m/s), for the specified stage. Flooding occurs when the water-surface level rises above the flood stage. The US National Weather Service defines flood stage as "an established gage height for a given location above which a rise in water surface level begins to create a hazard to lives, property, or commerce" (National Weather Service, 2014). Flood stage is therefore the chosen water level for flood warnings, and is "not necessarily the same as bankfull stage" (National Weather Service, 2014). The volume of discharge that can be carried in a cross-sectional river channel at flood stage can thus be computed as:

$$Q_{FS} = A_{FS} U_{FS} \tag{3.1.b}$$

where A_{FS} is the cross-sectional channel area at flood stage (m^2), and U_{FS} is the cross-sectional average flow velocity at flood stage (m/s) (Figure 3.2). This volume of flow that can be carried within the channel at flood stage can also be described as the channel capacity at flood stage (termed channel capacity), so:

$$CC = Q_{FS} \tag{3.2}$$

Because channel capacity may change over time, we refer to the average cross-sectional discharge at flood stage, over a given period, as $\overline{Q_{FS}}$.

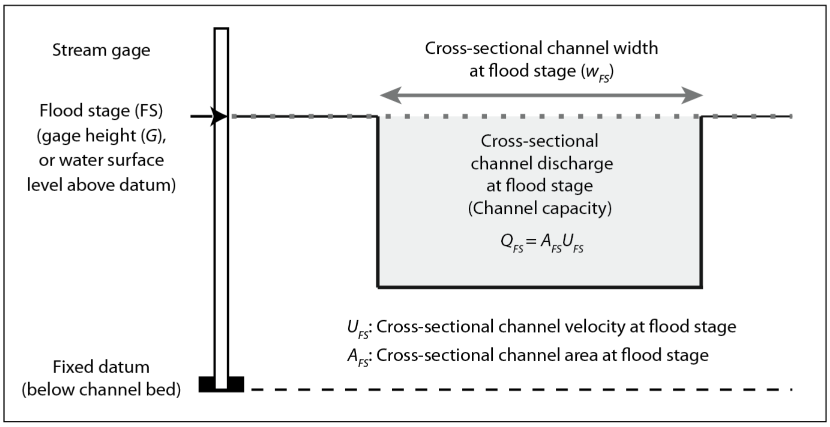


Figure 3.2. Schematic channel cross-section indicating channel flow at flood stage (Q_{FS}). Flood stage is represented as horizontal dotted line, and channel datum below the channel is indicated as horizontal dashed line.

The frequency with which flooding occurs is defined here as the number of days per year that river discharge equals or exceeds the local channel capacity. The flood hazard frequency at flood stage depends on two factors: (i) the frequency of flood stage flows generated from the upstream basin that equal or exceed the average channel capacity over a given period ($\overline{Q_{FS}}$), termed flow frequency; (ii) the capacity of the local channel cross section to carry the flow delivered from upstream (the volume of flow carried at flood stage, Q_{FS}), termed channel capacity.

Changes in either flood stage flow frequency or channel capacity can affect flood hazard frequency. Below we outline how these two distinct causes of change in flood hazard frequency can be quantified independently in order to assess their respective impacts on flood hazard.

3.2.2. Source data and initial filtering

The source data are: flood stage estimates for USGS gaging stations, mean daily streamflow records, and manual USGS field measurements of channel width, cross-sectional flow area, and cross-sectional average flow velocity for a range of flows from these same sites.

(i) Flood stage values are provided by the US National Weather Service (National Oceanic and Atmospheric Administration, 2014). We assume that each river's flood stage – the absolute altitude at which rising flows create a hazard to lives, property or commerce – is constant. Since estimates of that critical stage may improve over time, we used the most recent National Weather Service flood stage estimates for each site. Using a constant flood stage allows us to quantify temporal changes in the discharge that is required to reach it (i.e. the channel capacity).

(ii) Historical mean daily streamflow records are stored by the USGS and made publicly available online (U.S. Geological Survey, 2014c). In this analysis, we used mean daily streamflow data rather than annual peak flow data, to characterise flows that could potentially occur more frequently than once a year. We only retained the sites with mean daily streamflow records that were at least 90% complete. For the 401 sites, the mean record completeness is 99.7%, and the mean record length is 57.1 years.

(iii) Manual field measurements are made by the USGS at more than 7,000 active stream gages across the USA to maintain good rating curves between stage and discharge (U.S. Geological Survey, 2014d). In stream gaging, rating curves are used to convert stage measurements to estimates of how much discharge is flowing through the river channel cross-section at any given time. To develop the rating curves, the USGS make manual field measurements of channel dimensions (cross-sectional channel area and width (w)) and cross-sectional average flow velocity, and thereby calculate the amount of flow in the channel using equation 1.1 (Carter and Davidian, 1968), see chapter 1 for details. These measurements are repeated regularly to ensure that the rating curves are accurately maintained. Archives of the manual field measurements are made publicly available online (U.S. Geological Survey, 2014e). We retained only gaging sites with a minimum of 10 repeat channel cross-sections at each location after all filtering, as described in section 3.2.4 below. The mean number of measurements for the 401 sites is 40 channel cross-sections, and the mean record length is 37.3 years.

Following all of the filtering steps, including those described in section 3.2.4 below, only the sites where the discharge and manual field measurement records both spanned at least 20 years between 1 January 1950 and 30 June 2013 were retained.

3.2.3. Evaluation of flow modification

To assess channel capacity and flow frequency effects in the context of climate change, the sites were divided into categories of flow modification that indicate whether flow alterations may mask the influence of climate on streamflow generation and thus flood hazard frequency. The degree of flow modification was characterised for each site as follows:

(i) Mean daily streamflow time series (U.S. Geological Survey, 2014c) were carefully scrutinised on both linear and logarithmic axes (Figure 3.3), since the linear form of the hydrograph is most useful for distinguishing any changes in the magnitudes of the largest flows, while the logarithmic form amplifies any differences in the magnitudes of low flows, and aids detection of water withdrawals or diversions.

(ii) Any entries under "remarks" in the Annual Water Data Reports (U.S. Geological Survey, 2014f) were carefully evaluated for all sites where reports were available. The remarks provide information on the causes of flow modification (e.g. diversions, dams, different types of regulation, power plants, lakes, mills), and on the magnitude/type of modification (e.g. some/considerable regulation, permanent/intermittent regulation, regulation of low/high flows, size of diversions).

(iii) Maps and aerial images covering each basin were screened in Google Earth to detect any evidence of human impacts that could alter flows. Many of the sites (93%) are also in the Geospatial Attributes of Gages for Evaluating Streamflow (GAGES II) dataset (Falcone, 2011), which contains screening comments by personnel from the National Water-Quality Assessment Program for evidence of anthropogenic flow alterations (see chapter 2). Therefore, screening remarks were cross-referenced with the National Water-Quality Assessment Program comments, when these were available. Note that, in contrast with chapter 2, we also include sites that are not from GAGES II in this chapter in order to obtain a larger representation of catchment sizes and levels of flow modification (GAGES II does not include sites with catchment areas greater than 50,000 km^2).

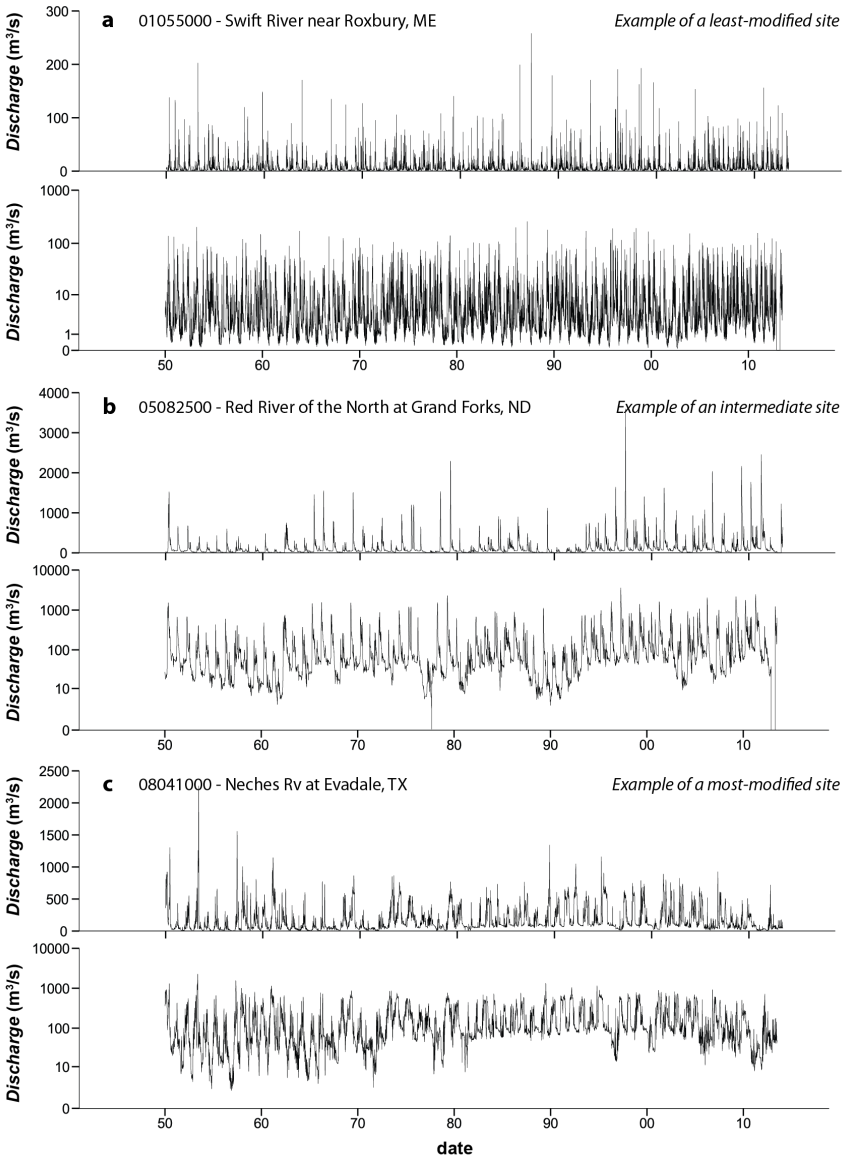


Figure 3.3. Evaluation of flow modification plotted on linear and log scales. Three mean daily streamflow time series (1950-2013) exemplify the three relative degrees of flow modification. (a) Swift River near Roxbury (ME) is a Least modified site, with minimal disturbance, as visible in its regular annual peaks and flow pattern; (b) The Red River of the North (ND) is an Intermediate site, where low-flows have been visibly modified, but the peaks to a much lesser extent; and (c) the Neches River at Evadale (TX) is a Most modified site, where the peaks have been capped by the upstream reservoir and the low flows have been visibly augmented.

Following these steps, the sites were classified into three relative categories based on their degree of flow modification (Figure 3.3), to assess whether flood hazard trends vary due to anthropogenic management and if changes at sites with lower levels of modification are consistent with regional climatic trends:

(i) Sites where the magnitudes of flood peaks were clearly affected by flow modification were classified as '*Most modified*'.

(ii) Sites where flow modification was visible or reported, but did not appear to affect the magnitudes of flood peaks, were classified as '*Intermediate*'.

(iii) Sites where flow modification was not clearly detectable from the mean daily streamflow data, not mentioned in the water reports, and not visible from the screening of maps and satellite photos were classified as '*Least modified*'.

3.2.4. Further filtering steps: measurement location and consistency

Several additional filtering steps were carried out to ensure consistency in manual field measurements for the computation of channel capacity. In addition, in order to quantify changes in Q_{FS}, A_{FS}, and U_{FS} in each cross-section (Figure 3.2), some tests were carried out to identify any manual field measurements that had obviously not been made consistently in the same location over time.

3.2.4.1. Selection of manual field measurements close to flood stage

The purpose of this chapter is to estimate the effects of channel capacity and flow frequency trends on the total flood hazard frequency at flood stage. However, manual field measurements of channel capacity are rarely made exactly at flood stage, so measurements made over a wider range of stages were used, based on a procedure that extrapolates channel capacity changes to flood stage, as explained below.

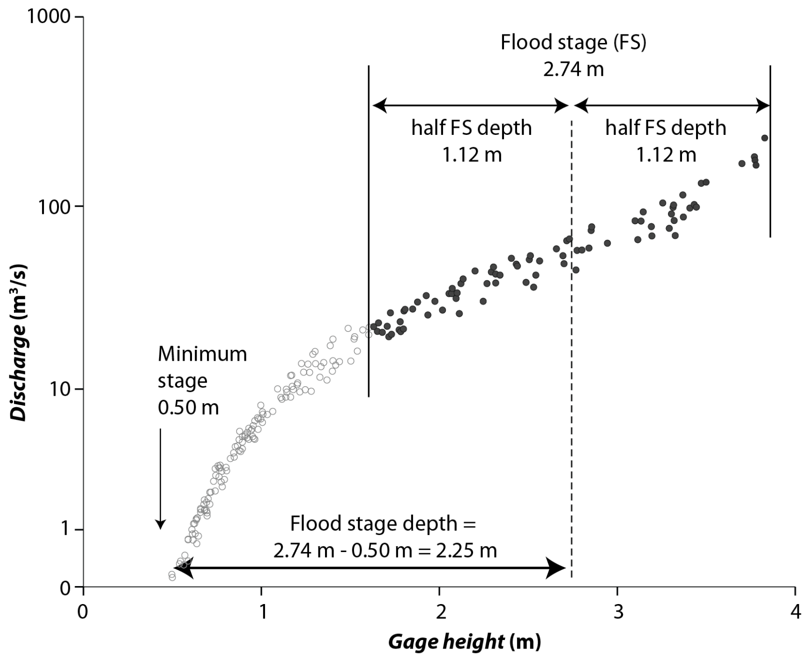


Figure 3.4. Selection of manual field measurements at USGS site 0648000, Big Sioux River near Brookings, SD (Note: the same site is also used, for consistency, in Figure 3.5 to Figure 3.10). Flood stage is indicated by dashed vertical black line (2.74m). Dark grey circles represent manual field measurements selected within a range of half the flood stage depth on either side of flood stage, and were retained for subsequent analysis. Open circles indicate measurements that were omitted from the subsequent analysis because they fell outside this range around flood stage.

3.2.4.2. Water Data Reports filtering

Within the Water Data Reports (U.S. Geological Survey, 2014f), under the section "gage", we identified:

(i) Weirs and artificial controls at the gaging location. These are hard structures in the river channel that resist erosion and stabilise the stage-discharge relation, thereby facilitating the measurement of discharge. They are used to eliminate or alleviate "the adverse effects of unstable conditions due to shifting bed or banks, the formation of ice in winter, progressive growth of aquatic vegetation during the summer, and other phenomena which at times affect the stage-discharge relation at low stages" (Carter and Davidian, 1968). This means that they prevent part of the channel from adjusting its cross sectional shape. Thus, any sites where either weirs or controls were mentioned were removed, since they would artificially limit changes in channel capacity.

(ii) Changes in manual field measurement location and gage datum. The gage datum is the level plane that represents zero elevation of the stream gage (Figure 3.2). Its level is intended to remain unchanged over the life of the gaging station, and therefore is selected well below the estimated maximum scour depth (Kennedy, 1990; Kenney, 2010). Changes in gage location and gage datum are typically reported in the Water Data Reports, noted as follows: e.g, "Oct. 1975 to Aug. 1983 crest-stage gage at site 500 ft upstream at different datum". For every mention of a change in datum or gage location, we systematically removed the most recent year of the change, as well as any manual field measurements that were made in that year or any preceding years. The exact date of change in datum/location was not always provided in the reports, so we conservatively discarded the full year of data in which such a change occurred.

3.2.4.3. USGS manual field measurement filtering

Within the USGS manual field measurements (U.S. Geological Survey, 2014e), we removed:

(i) Manual field measurements taken in icy conditions. Such measurements are undesirable because ice in the channel may affect inferred channel geometry.

a. The data column *meas_type* describes the method used to suspend or place measurement instrumentation into the water, and indicates discharge measurements that were made through river ice (ICE).

b. The data column *control_type_cd* describes the condition of the rating control at the time of the measurement, and specifies when the control was covered by ice (CICE), affected by anchor ice (AICE), or by shore ice (SICE). All measurements taken in icy conditions were discarded.

(ii) Missing measurements. If any one of the Q, A, U, or w meaurements had a negative, zero, or missing value on a given date, we removed the entire collection of measurements (Q, A, U, and w) made on that day.

(iii) Measurement inaccuracies. To remove any potential inaccuracies in Q, A, or U, we filtered for potential measurements by calculating, following equation (3.1.a):

$$\frac{Q}{AU} \tag{3.3}$$

and removing any measurements where this ratio was not equal to 1, within a range of ± 1%.

(iv) Measurements taken at a distance from the gage:

a. The data column *chan_loc_cd* specifies which measurements were made at the gage (ATGA), or at a different location upstream (UPST) or downstream (DNST) from the gaging station. We deleted all measurements that were marked UPST or DNST.

b. The data column *chan_loc_dist* indicates the distance at which measurements were known to have been taken from the gaging station. We removed all measurements where the indicated values were larger than zero.

3.2.4.4. Visual verification of measurement location

Despite the above-mentioned indications regarding manual field measurement location in the Water Data Reports and field measurement files, precise measurement locations are typically missing from the data files for the majority of measurements. Manual field measurements are often made at a distance from the principal gaging site, which is not an issue if the measurement location is consistent over time. However, if the measurement location is variable, computed trends in channel capacity will be incorrect. It is therefore vital that such measurements are identified and excluded from the analysis.

Unfortunately, it is difficult to discern, using automated methods, where manual field measurements are made, and scatterplots (e.g. Q *versus* G), do not always elucidate these inconsistencies in measurement location (e.g. Figure 3.5a). Therefore, we visually cross-verified scatterplots of w, A, and U *versus* G. This step was helpful for detecting likely changes in measurement location. In particular, the presence of groups of outliers across the various scatterplots are strong indicators of shifts in measurement location (or datum). We systematically removed these measurements.

For example, the scatterplot of discharge *versus* gage height for Big Sioux River near Brookings, SD (Figure 3.5a), exhibits some scatter about flood stage, but does not obviously suggest that manual field measurements were made in different locations. Close inspection of the scatter plots of width and area, *versus* gage height (Figure 3.5b-c), however, reveals inconsistencies that suggest that measurements were made in different locations. Manual field measurements were manually filtered where the measurement locations were obviously inconsistent.

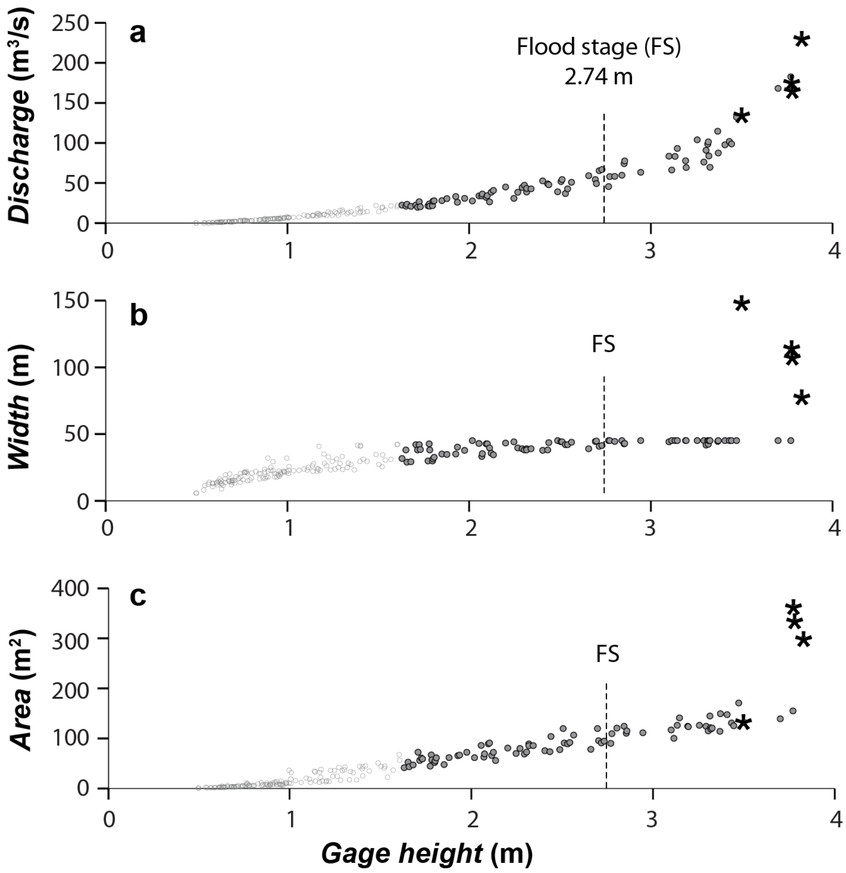


Figure 3.5. Example of manual field measurement filtering at Big Sioux River near Brookings, SD. Flood stage is indicated by dashed vertical black line. The scatterplot of cross-sectional channel discharge versus gage height (a) gives no indication that the manual field measurements come from multiple measurement locations. By contrast, the scatterplots relating width (b), and cross-sectional area (c), to gage height clearly suggest the presence of different measurement locations and/or measurement error at high values of stage. We systematically cross-compared scatterplots at all sites, and retained only the measurements that did not visibly belong to multiple measurement locations (selecting only the most consistent-looking location, in cases where several measurement locations were apparent). The dark grey circles represent retained measurements that are within a range of half the flood stage depth on either side of flood stage (see Figure 3.4), and that do not obviously indicate different measurement locations. Open

circles indicate measure-ments that were outside range of half the flood stage depth on either side of flood stage, and were excluded from subsequent analysis. The four black star symbols indicate measurements that were within the range of retained measurements but were discarded from subsequent analysis because they were indicative of a different measurement location or measurement error.

3.2.5. Estimation of channel discharge, area, and velocity at flood stage

For each site, we define the average value of *Q*, *A*, and *U* at flood stage ($\overline{Q_{FS}}$, $\overline{A_{FS}}$ and $\overline{U_{FS}}$), from the available manual field measurements. While flood stage values of *Q*, *A*, and *V* may vary over time, $\overline{Q_{FS}}$, $\overline{A_{FS}}$ and $\overline{U_{FS}}$ are fixed values representing their averages over the entire period of record. $\overline{Q_{FS}}$ is used to compute both the flow frequency effect and the channel capacity effect on flood hazard frequency (sections 3.2.6 and 3.2.7, respectively), while $\overline{A_{FS}}$ and $\overline{U_{FS}}$ are used to compute the trend in cross-sectional channel area and cross-sectional average flow velocity at flood stage (section 3.2.8).

To quantify these values, we used Loess (Cleveland, 1979), Locally weighted Scatterplot Smoothing, which uses local regression to fit a smooth curve through the data, point by point, based on a neighbourhood of measurements. For each site, the measurements were converted to metric units, a Loess curve was used to relate the natural logarithms of *Q*, *A* and *U* to the natural logarithm of *G*. Loess fits a smooth nonparametric curve that systematically discounts the influence of outliers (points with unusually large deviations from the rest of the data). The degree of smoothing is controlled by a parameter α (Ripley, 2014). The value of 0.75 was retained because it provided a good fit to the data.

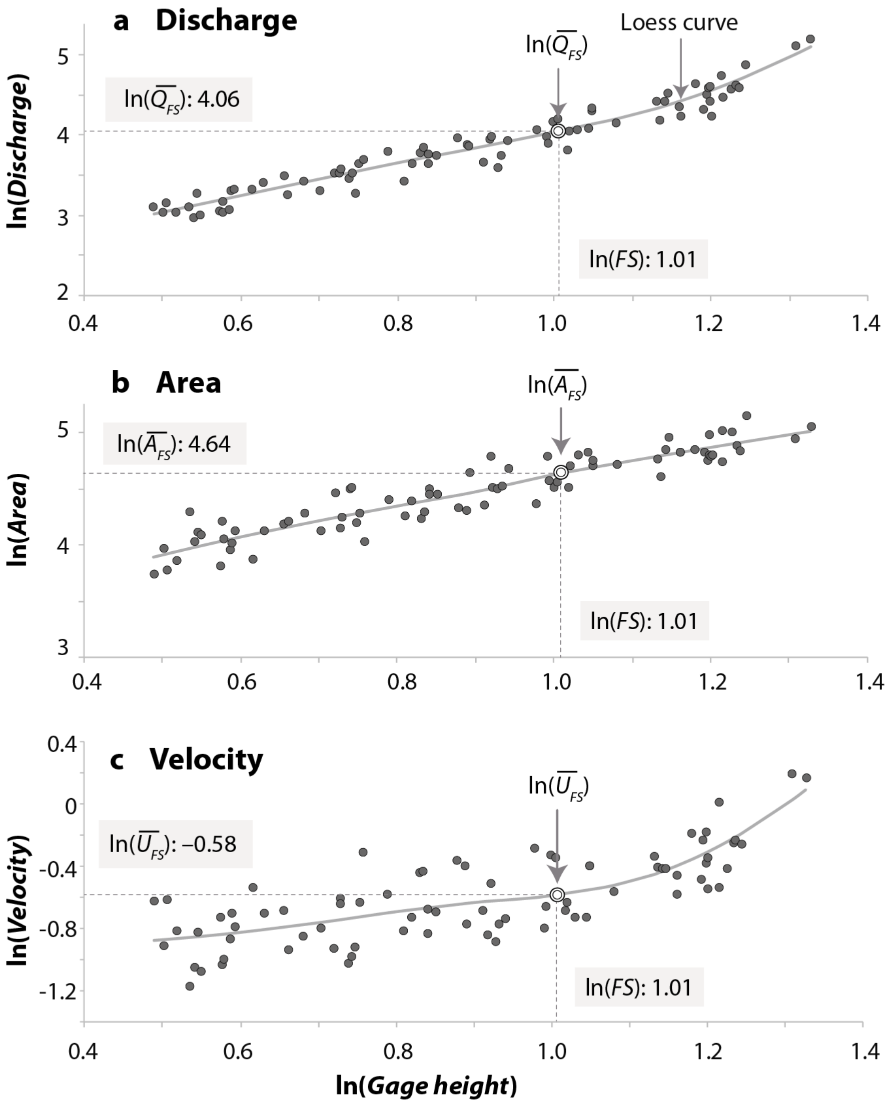


Figure 3.6. Rating curves for (a) ln(Q) (b), ln(A) and (c), ln(U) versus ln(G) (m), 1984-2013, at Big Sioux River near Brookings, SD. Dark grey circles represent manual field measurements that were retained following filtering steps (as indicated in Figure 3.4 and Figure 3.5). Grey curve represents the Loess fit to the measurements. The interpolated values of $\overline{Q_{FS}}$, $\overline{A_{FS}}$ *and* $\overline{U_{FS}}$ *at the flood stage (ln(FS)=1.01), are indicated by thin dashed grey lines.*

Using the predict.loess function from the R statistical programming language (Ripley, 2014) and the defined values of flood stage (section 3.2.2), we identified and recorded the y-axis values where each curve intersected flood stage. Thus, we obtained the value of $\overline{Q_{FS}}$ from the ln(*G*)-ln(*Q*) curve (Figure 3.6a), $\overline{A_{FS}}$ from the ln(*G*)-ln(*A*) curve (Figure 3.6b), and $\overline{U_{FS}}$ from the ln(*G*)-ln(*U*) curve (Figure 3.6c) for each site.

3.2.6. Trend in flood stage flow frequency

3.2.6.1. Computing flow frequency

To isolate trends in flow frequency from changes in channel capacity, the annual flood stage flow frequency (*FF*) was quantified as the number of mean daily streamflow values in each year that equalled or exceeded a fixed flood stage discharge:

$$FF = sum\left(Q \geq \overline{Q_{FS}}\right) \tag{3.4}$$

where Q is each mean daily streamflow value, and $\overline{Q_{FS}}$ is the reference cross-sectional discharge at flood stage for each site, determined in section 3.2.5 above. Note that equation 3.4 expresses the frequency of flows that exceed the *fixed average* flood stage discharge, although the *actual* flood stage discharge may change over time as channel capacity changes. Thus, *FF* quantifies the flood hazard frequency and changes in flood hazard frequency (see below) that would arise in the absence of trends in channel capacity. Because streamflow can potentially remain above flood stage for several days within the same event, a flow frequency of several days per year does not necessarily mean that there were several events in that year. We only calculated flow frequency for calendar years with nearly complete data (≥ 350 mean daily streamflow values).

3.2.6.2. Trend characterization

The long-term trend in flow frequency was characterised using a simple curve with few parameters. Linear trends are not suitable for this purpose because they can predict negative flow frequency values, which are physically impossible. Instead, we fit exponential trends to the flow frequency time series (on linear axes, in order to preserve values of flow frequency = 0), as shown in Figure 3.7.

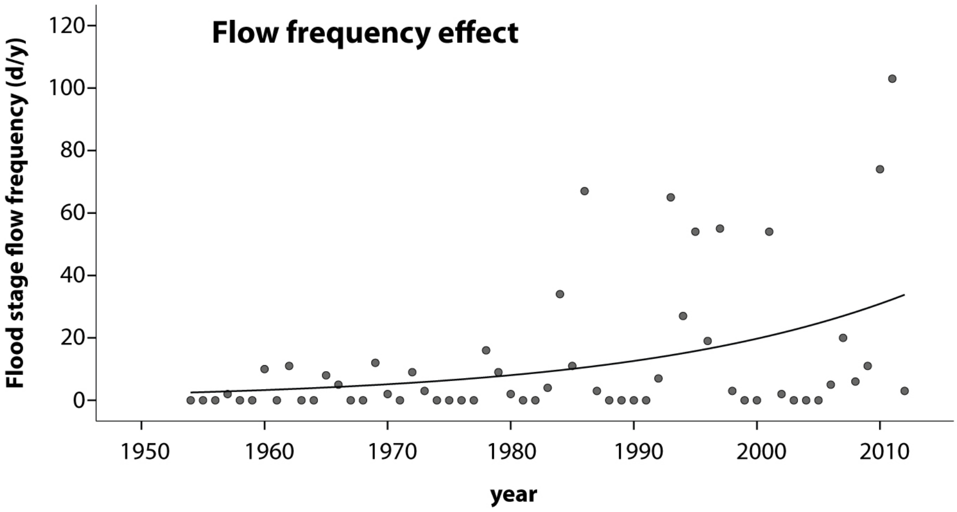


Figure 3.7. Flow frequency trend (in units of flood stage flow frequency, d/y) versus year at Big Sioux River near Brookings, SD. Dark grey circles represent computed values of flood stage flow frequency (number of days with mean discharge equalling or exceeding $\overline{Q_{FS}}$ each year). Grey exponential curve represents the mean-unbiased exponential trend in annual flood stage flow frequency. This site has a mean flood stage flow frequency of 12 days per year, and a trend in flood stage flow frequency of 45% per decade.

To eliminate one fitting coefficient, but still guarantee that the mean flow frequency in the fitted curve would equal the mean observed flow frequency, nonlinear least squares was used to fit the following unbiased-mean exponential curve to the flow frequency time series:

$$\frac{FF}{mean(FF)} = \frac{\exp(r\Delta t)}{mean(\exp(r\Delta t))} \tag{3.5}$$

where *mean(FF)* is the mean of the observed flood stage flow frequencies, r is the fractional change in flow frequency per unit of time, and Δt = date–mean(date). If Δt is expressed in decades, then 100 times the coefficient r yields rate of change in flood-stage flow frequency in percent per decade, as reported in Figure 3.11.

3.2.6.3. Trend significance

A Monte Carlo permutation method was used to assess the significance of these trends, because permutation tests require no distributional assumptions and the flow frequency distributions are often strongly skewed. Using the annual flow frequency values obtained in section 3.2.6.1, 10,000 sample time series were generated by randomly re-ordering the flow frequency values, and the trend parameter r was calculated using equation 3.5 for each re-sampled time series. The statistical significance of the real-world r value was estimated from the fraction of permutation trials that gave equal or greater absolute values of r. This permutation test assumes that there is negligible serial correlation in the flow frequency time series. The lag-1 serial correlation in the residuals from the fitted flow frequency trends averaged -0.013 (median absolute value) across the 401 sites, demonstrating that this assumption is reasonable for these data.

3.2.7. Channel capacity effects on flood hazard frequency

Changes in channel capacity can also affect flood hazard frequency independently from any shifts in flow frequency. In this section, we quantify the channel capacity effect as the trend in flood hazard frequency that would arise from the observed shifts in channel capacity at flood stage, if the flow frequency distribution were held constant.

3.2.7.1. Estimated values of flow at flood stage

We evaluate the channel capacity effect on flood hazard frequency at the same flood hazard threshold as the flow frequency effect, namely the defined flood stage (G=FS). However, since manual field measurements of cross-sectional discharge are rarely made exactly at flood stage, we need to estimate what Q would have been at flood stage, at the time when each manual field measurement was made.

As explained by Helsel and Hirsch (1993), in cases where several variables (e.g. time and G) may affect the magnitude of a response variable (here, Q), the effects of the extraneous explanatory variable (G) may be removed by fitting a smooth curve to its relationship with the response variable (here, a curve relating Q to G) and using the residuals from the curve in subsequent analyses. This corrects for changes in G without assuming that the relationship between G and Q has any particular functional form.

To remove the effect of differences in gage height on the relationship between the manually measured Q and time, we used the Loess curve (Figure 3.8) relating the natural logarithms of Q to G, computed in section 3.2.5. The residuals to each Loess curve were computed as:

$$\ln\left(\hat{Q}_{\varepsilon_i}\right) = \ln\left(Q_i\right) - \ln\left(\overline{Q}_i\right) \tag{3.6}$$

where $\ln\left(Q_i\right)$ are the natural logarithms of the observed values of Q, and $\ln\left(\overline{Q}_i\right)$ are the natural logarithms of the estimated values from the Loess curve, obtained using the predict.loess function from the R statistical programming language (Ripley, 2014), as explained in section 3.2.5.

Assuming that the Loess curve represents the time-averaged values of ln(Q) for each value of ln(G), the values of the residuals (positive or negative) indicate whether each measurement of ln(Q) is less than or greater than the fitted value of ln(Q) for that value of ln(G). One can then infer that the residuals are representative of the temporal changes in ln(Q_{FS}), under the premise that the temporal trend of residuals at flood stage is the same as that of residuals over the rest of the curve as a whole. For example, if early values of Q tend to lie above the line (positive residuals) and later values of Q tend to lie below the line (negative residuals), it is reasonable to infer a temporal trend toward lower discharges at any given gage height, including flood stage (i.e., a decrease in channel capacity).

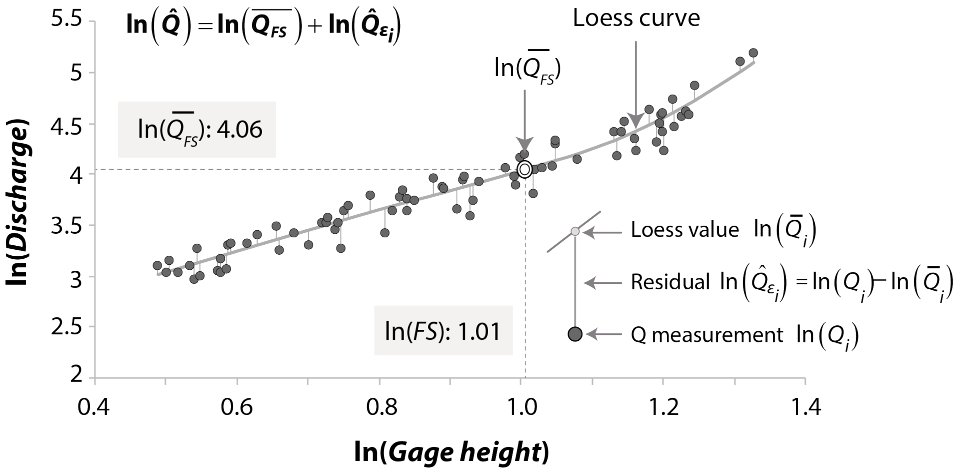


Figure 3.8. Estimating values of cross-sectional discharge at flood stage, at Big Sioux River near Brookings, SD (section 3.2.7.1). Dark grey circles represent manual field measurements of cross-sectional discharge that were retained following filtering steps (as indicated in Figure 3.4 and Figure 3.5). The grey curve represents the Loess fit to the measurements. Vertical grey lines represent residuals from the Loess rating curve, which indicate how each measurement of ln(Discharge) deviates from the average value of ln(Discharge) for the corresponding value of ln(Gage height). The interpolated value of $\overline{Q_{FS}}$ *is indicated by the thin dashed grey line. Assuming that the residuals are representative of the temporal changes in* $\ln(Q_{FS})$*, we calculate the estimated values of cross-sectional discharge at flood stage at each point in time,* $\ln(\hat{Q})$*, as the sum of* $\ln(\overline{Q_{FS}})$ *and the residual* $\ln(\hat{Q}_{\varepsilon i})$.

The estimated values of flow at flood stage are obtained as:

$$\ln(\hat{Q}) = \ln(\overline{Q_{FS}}) + \ln(\hat{Q}_{\varepsilon i}) \quad (3.7)$$

where $\ln(\hat{Q}_{\varepsilon_i})$ is the residual of the Loess curve relating $\ln(Q)$ to $\ln(G)$. $\overline{Q_{FS}}$ was computed in section 3.2.5. The resulting $\ln(\hat{Q})$ values are the estimates of ln(Q) that would be required, at the time of each manual field measurement, to reach flood stage (Figure 3.8).

3.2.7.2. Quantifying channel capacity effects on flood hazard frequency

To estimate how changes in channel capacity affect flood hazard frequency, we estimated how frequently each value of $\hat{Q}$ would be attained, given the probability distribution of mean daily streamflow values for each site. To do this, we first computed the exceedance curve relating the exceedance frequency F to q, as:

$$F_{\mathrm{i}} = 365 * \frac{rank(q_i)}{(n+1)} \tag{3.8}$$

where rank(q_i) is the rank of each mean daily streamflow value, in descending order, so that the largest flow has the smallest rank; and n is the total number of mean daily streamflow values between 1 January 1950 and 30 June 2013. Multiplying by 365.25 annualises the flood frequency, to obtain the exceedance frequency in days per year.

For each site, we plotted the exceedance curve for mean daily streamflow values, using log-log axes so that the distribution would not be sharply curved (Figure 3.9). To smooth any variability in the exceedance curves, we fit a Loess curve (as explained in section 3.2.5) to the mean daily streamflow values. We used only mean daily streamflow values that were situated within a range of 0.2 log units beyond the $\ln\left(\hat{Q}\right)$ values (Figure 3.9) to ensure a good Loess fit near the $\ln\left(\hat{Q}\right)$ values (because these are often located at the tail of the exceedance frequency distribution) (Figure 3.9). We then extracted the exceedance frequencies of each $\ln\left(\hat{Q}\right)$ from the Loess curve. At 3 sites (<1% of all sites), a total of 25 $\hat{Q}$ values (<0.2% of all $\hat{Q}$ values) were found to exceed the highest mean daily streamflow values on record, and so could not be interpolated from the Loess curve. These values were considered unreliable and so were removed from the computation of channel capacity effects.

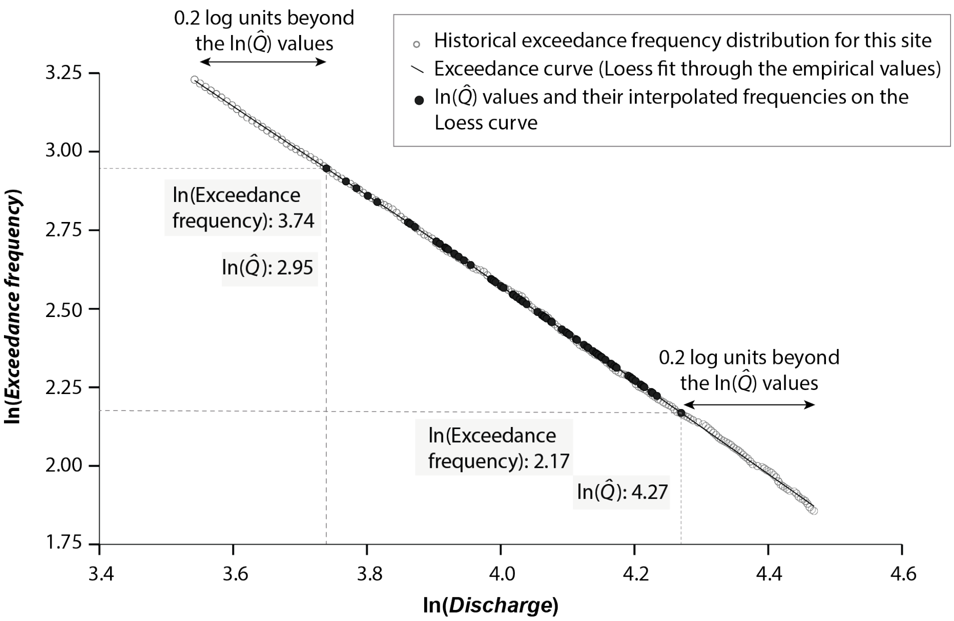


Figure 3.9. Exceedance curve relating ln(Exceedance frequency) to ln(Discharge) at Big Sioux River near Brookings, SD. Exceedance frequencies of historical mean daily streamflow values are indicated as open grey circles. The thin black line indicates Loess fit to these exceedance frequencies. Extracted exceedance frequencies for estimated $\hat{Q}$ values are indicated as filled, dark grey circles: these are the exceedance frequencies used to compute the trend in flood hazard attributable to changes in channel capacity (Figure 3.10).

3.2.7.3. Quantification of flood hazard frequency trends due to changes in channel capacity (Figure 3.10)

In the same way as for flow frequency in section 3.2.6, we sought to characterise the long-term trend in flood hazard frequency due to changes in channel capacity, using a simple curve with few parameters. However, in contrast with flow frequency, where there is little error in the estimated flow frequency values (because it is clear whether each mean daily streamflow value equals or exceeds $\overline{Q_{FS}}$), there is a greater chance of finding outliers in channel capacity, due to measurement errors or undetected variations in manual field measurement locations. It is therefore important to downweight the influence of any such outliers to limit their influence on the trend estimates.

To downweight the influence of outliers, we computed an iteratively reweighted least squares (IRLS: Holland and Welsch, 1977) trend in the non-logged frequencies obtained for $\hat{Q}$ from the exceedance curve for each site. IRLS is an iterative procedure that is typically used to mitigate the influence of outliers in regression models. In our IRLS routine, we used a Cauchy weighting function (Holland and Welsch, 1977), applied to the residuals from the fitted function, so as to minimise the influence of outliers, as:

$$w_i = \frac{1}{1 + \left(\frac{a_i}{3.536MAR} \right)^2} \tag{3.9}$$

where a_i is the residual corresponding to an individual point, and MAR is the median absolute residual. So that the effects of changes in channel capacity and flow frequency are quantitatively comparable, we used the same exponential unbiased mean form of the least squares trend as for flow frequency. The trend in the corresponding F_i values was fit as:

$$\frac{F_i}{wt.mean(F_i)} = \frac{\exp(r\Delta t)}{wt.mean(\exp(r\Delta t))} \tag{3.10}$$

where $wt.mean(F_i)$ is the weighted mean of the exceedance frequency at flood stage, $\hat{Q}$, using the IRLS weights for each point, r is the fractional change in channel capacity per unit of time, and Δt = date–mean(date), as before. Figure 3.10 shows the exponential IRLS trend passing through the exceedance frequencies, after the down-weighting of outliers.

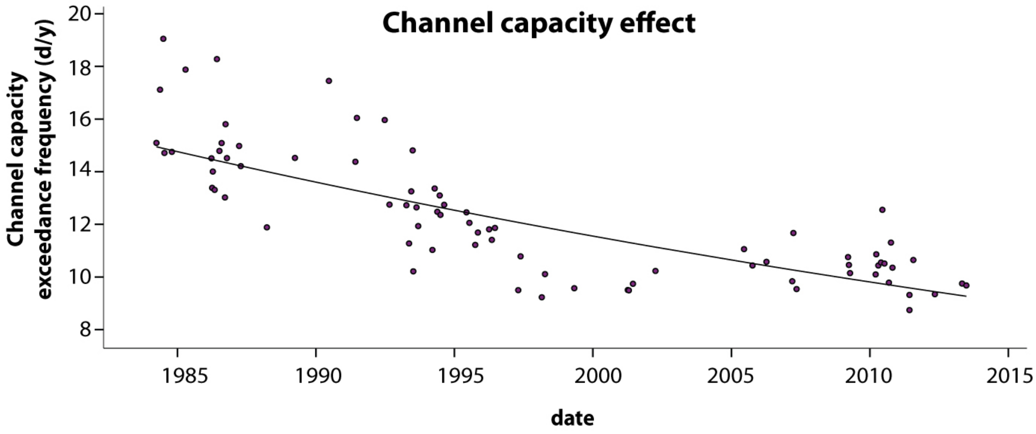


Figure 3.10. Trend in flood frequency due to channel capacity changes, at Big Sioux River near Brookings, SD. Dark grey circles indicate $\hat{Q}$ exceedance frequency values, which were extracted from the exceedance curve (dark grey circles in Figure 3.9). Dark grey curve indicates mean-unbiased exponential IRLS trend for these exceedance frequencies. Note: the curves are exponential, but the curvature is indistinct for many sites due to the scatter in the underlying data. At this site, the $\hat{Q}$ exceedance frequency values display considerable variability due to the frequent adjustments of the sand and silt channel boundaries. The channel capacity effect on the flood hazard frequency is of −16% per decade.

We tested for lag-1 serial correlation in the residuals from the fitted trends, and found a median correlation of 0.13. Accounting for serial correlation barely modified the estimated trend significances (it increased p-values by + 0.0037 on average, for the 401 sites). Thus, we concluded that the raw IRLS exponential weighted mean model could be used without correcting for serial correlation.

The effects of channel capacity changes on flood hazard are computed in percent per decade (r times 100, with Δt expressed in decades), allowing for a direct comparison between channel capacity and flow frequency effects (Figure 3.7 and Figure 3.10). This also means that the sum of channel capacity and flow frequency effects (both in percent per decade) corresponds to the total change in flood hazard frequency (in percent per decade) at each site.

3.2.8. Trends in channel area and flow velocity at flood stage

Channel capacity can be divided into the two components that determine the volume of flow at flood stage, namely cross-sectional channel area and cross-sectional average flow velocity (equation 3.1b). The aim is to determine the proportions of changes in channel capacity that result from shifts in A_{FS} and from shifts in U_{FS} for each site, assuming that the flow frequency distribution remains constant over time. To do this, the temporal trend in A_{FS} and U_{FS} is quantified in percent per decade.

3.2.8.1. Estimated values of cross-sectional area and cross-sectional average flow velocity at flood stage

In the same way as described for flow, in section 3.2.7.1, manual field measurements of A and U are rarely made exactly at flood stage. However, estimates of A and U can be obtained at flood stage by removing the effect of differences in gage height. To do this, we use the Loess curves relating the natural logarithms of A and U to G, which were computed in section 3.2.5. In the same manner as for Q in Figure 3.8, the residuals to each Loess curve are computed as:

$$\ln\left(\hat{A}_{\varepsilon_i}\right) = \ln\left(A_i\right) - \ln\left(\overline{A_i}\right) \tag{3.11.a}$$

$$\ln\left(\hat{U}_{\varepsilon_i}\right) = \ln\left(A_i\right) - \ln\left(\overline{U_i}\right) \tag{3.11.b}$$

where $\ln\left(A_i\right)$ and $\ln\left(U_i\right)$ are the natural logarithms of the observed manual field measurements, and $\ln\left(\overline{A_i}\right)$ and $\ln\left(\overline{U_i}\right)$ are the natural logarithms of the estimated values from the Loess curve, obtained using the predict.loess function from the R statistical programming language (Ripley, 2014), as explained in section 3.2.5).

Assuming that the Loess curve represents the time-averaged values of ln(A) and ln(U) for each value of ln(G) (Figure 3.6b-c), the values of the residuals (positive or negative) indicate whether each manual field measurement of ln(A) or ln(U) is less than or greater than the average value of ln(A) or ln(U) for that value of ln(G), following the same procedure as for Q in Figure 3.8. As long as the temporal trend of residuals at flood stage is the same as that of residuals over the rest of the curve as a whole, one can then assume that the residuals are representative of the temporal changes in ln(A_{FS}) or ln(U_{FS}). The estimated values of ln(A) and ln(U) at flood stage are obtained as:

$$\ln\left(\hat{A}\right) = \ln\left(\overline{A_{FS}}\right) + \ln\left(\hat{A}_{\varepsilon_i}\right) \tag{3.12.a}$$

$$\ln\left(\hat{U}\right) = \ln\left(\overline{U_{FS}}\right) + \ln\left(\hat{U}_{\varepsilon_i}\right) \tag{3.12.b}$$

where $\ln\left(\hat{A}_{\varepsilon_i}\right)$ are the residuals of the Loess curve relating ln(A) to ln(G), and $\ln\left(\hat{U}_{\varepsilon_i}\right)$ are the residuals of the Loess curve relating ln(U) to ln(G). $\overline{A_{FS}}$ and $\overline{U_{FS}}$ were obtained in section 3.2.5. The resulting ln($\hat{A}$) and ln($\hat{U}$) values are the estimates of ln(A) and ln(U) that that would be required, at the time of each manual field measurement, to reach flood stage.

3.2.8.2. Trend characterization

The time trends in $\hat{A}$ and $\hat{U}$ can be computed using a similar curve as for the channel capacity trend in section 3.2.7.3:

$$\frac{\hat{A}}{mean(\hat{A})} = \frac{\exp(r\Delta t)}{mean(\exp(r\Delta t))} \tag{3.13.a}$$

$$\frac{\hat{U}}{mean(\hat{U})} = \frac{\exp(r\Delta t)}{mean(\exp(r\Delta t))} \tag{3.13.b}$$

where *mean(*$\hat{A}$*)* and *mean(*$\hat{U}$*)* are the means of the estimates of A and U at flood stage; r is the fractional change in $\hat{A}$ or $\hat{U}$ per unit time; and Δt = date–mean(date).

3.3. Results

3.3.1. Number and magnitude of trends

In total, more than half of all the sites (57%, 227/401) showed statistically significant ($p<0.05$) channel capacity or flow frequency effects (positive or negative) on flood hazard frequency, suggesting that flood hazard is generally non stationary. This finding undermines most efforts to characterize flood hazard over decadal timescales by fitting theoretical probability distribution functions to historical flood records.

Significant flow frequency effects on flood hazard flow frequency were typically larger than significant channel capacity effects (medians: +30%/−64% per decade for flow frequency, *versus* +10/−10% per decade for channel capacity Figure 3.11). However, significant channel capacity effects were nearly three times more common than flow frequency effects (190 *versus* 71 sites), (Figure 3.11), suggesting that trends in channel capacity are more widespread and/or easier to detect over decadal timescales. Also, because this analysis relies on USGS gaging stations, which are generally sited in relatively stable channel cross sections (Carter and Davidian, 1968), channel capacity effects on flood hazard may even be larger and more widespread than those documented here.

Thus, although flow frequency effects typically dominate discussions about trends in flood hazard, our results suggest that channel capacity trends are important contributors that may alter flood risks independently from streamflow and even in the absence of climate change.

3.3.1. Effect of trends on flood hazard

The direction (+/–) of channel capacity and flow frequency effects were analysed separately to determine their tendency to raise or lower flood hazard frequency. At our sites with the *Least* and *Intermediate* levels of anthropogenic flow modification, streamflow trends increased flood hazards almost twice as often as they decreased them (193 *versus* 98 sites, p<0.001 by sign test, Figure 3.11a). These less-impacted sites are more likely to reveal climatic effects on flood hazards, whereas climatically driven trends at the *Most* altered sites are more likely to be obscured by anthropogenic flow modifications.

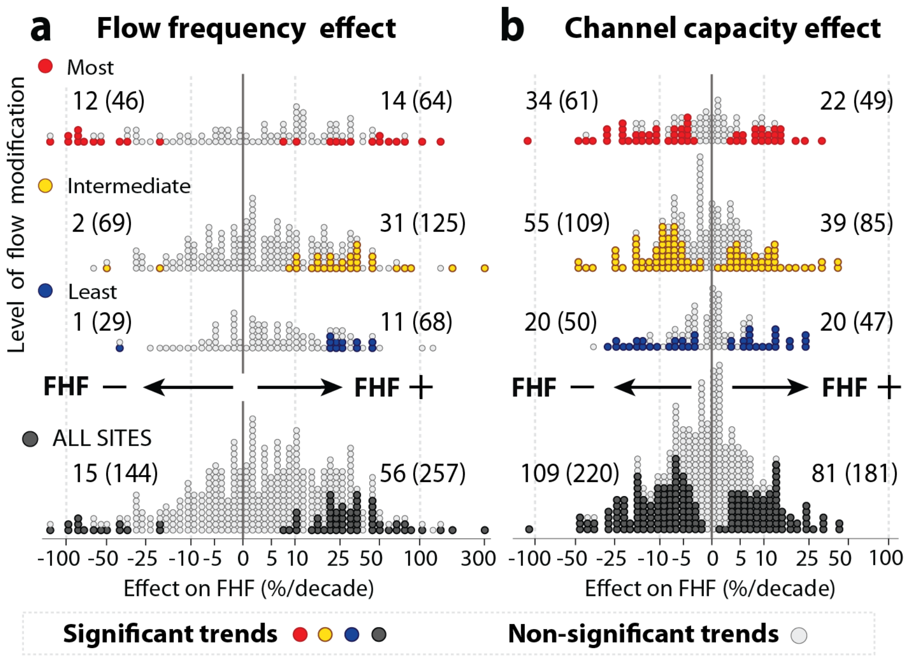


Figure 3.11. Histograms of (a) flow frequency effects and (b) channel capacity effects on flood hazard frequency, in %/decade. Each circle represents one gaging site, and statistically significant sites are represented with colour-filled circles, and non-significant sites with pale grey circles. Sites are grouped into three classes based on degree of anthropogenic streamflow modification: Most modified (red), Intermediate (yellow), and Least modified sites (blue). The number of significant sites (separated by positive/negative signs) is indicated above each distribution, and total number of sites (including non-significant sites) is shown in parentheses. Because distributions were strongly leptokurtic (clustered around ± 5%), we displayed the distributions using an inverse hyperbolic sine transform.

Most previous flood hazard studies have found no systematic increase in flood frequency across the United States during the 20th century (Douglas et al., 2000; Lins and Slack, 2005; McCabe and Wolock, 2002), a finding that has been widely cited in various climate reports (Field et al., 2012; Kundzewicz et al., 2014). However, some recent work has suggested that streamflow magnitudes have increased in the Northeastearn and Midwestern USA (Villarini et al., 2009; Villarini and Smith, 2010), and have decreased in the Southeast and Southwest (Hirsch and Ryberg, 2012).

Among the sites, increasing flow frequency trends were concentrated within the Mississippi River Basin and the Northeast, whereas decreasing flow frequency trends were found in more circumscribed areas of the Northwest and Southeast USA (Figure 3.12a). This geographic pattern is consistent with documented trends in heavy and extreme precipitation events (DeGaetano, 2009; Villarini et al., 2013; Janssen et al., 2014), and 10-year trends in regional groundwater levels inferred from GRACE satellite observations (Famiglietti and Rodell, 2013), suggesting that climatic trends may translate into measurable changes in flood hazard frequency.

In contrast to the flow frequency results, there were approximately equal numbers of sites with increasing and decreasing channel capacity, with no significant differences among flow modification categories (Figure 3.12b). This suggests that channel capacity trends do not respond in a simple way to anthropogenic streamflow modification, and instead may result from local interactions between discharge and the net sediment mass balance and/or boundary roughness.

Channel capacity effects tended to reduce flood hazard frequency in the Mississippi River Basin (through increasing channel capacity), and tended to increase flood hazard in the Northwest (through decreasing channel capacity, Figure 3.12b), suggesting that there may be regional imbalances between volumes of streamflow and sediment supplied to channels.

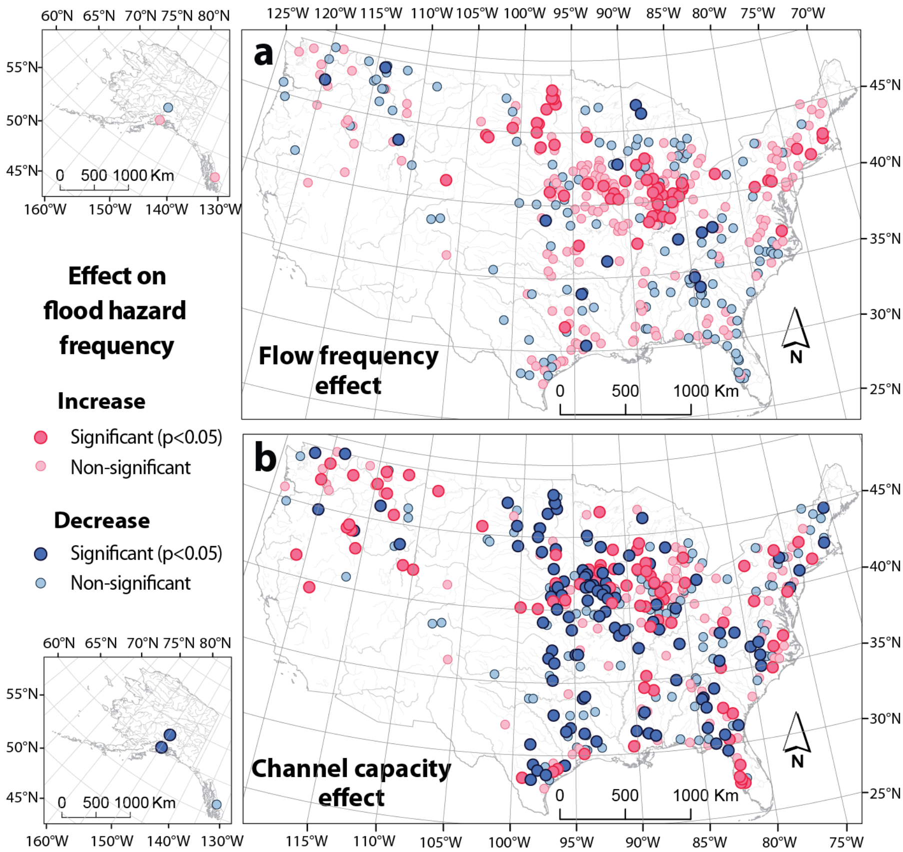


Figure 3.12. Spatial distributions of (a) flow frequency effects and (b) channel capacity effects on flood hazard frequency across the USA. Red represents increases in flood hazard frequency and blue represents decreases in flood hazard frequency. Deeper colours indicate sites with statistically significant trends.

The two components of channel capacity, i.e. changes in channel cross-sectional area and average flow velocity, contributed almost equally to channel capacity trends. On average, a 1% decrease in channel velocity or in flow area generated a 2% increase in flood hazard frequency (and vice-versa). These findings suggest that shifts in sediment flux, grain size, and/or vegetation may have a substantial role in controlling flood hazard frequency, particularly in basins undergoing land-use changes or in tectonically active regions.

3.3.2. Are river channels expressing regime theory?

Regime theory (Lane, 1955; Griffiths, 1983) holds that the cross-sectional channel capacity should adjust through changes in channel geometry and/or roughness to accommodate larger or smaller flows from upstream (Leopold and Maddock, 1953), thus tending to counteract any changes in flood hazard frequency due to flow frequency trends. For example, positive flow frequency trends could erode sediment and thereby increase channel capacity (producing a negative channel capacity effect), which attenuates the flow frequency effect on flood hazard frequency.

We evaluated whether regime theory is applicable across the sites by comparing the direction of channel capacity and flow frequency effects on flood hazard frequency at each site. If channels are adjusting according to regime theory (Lane, 1955; Griffiths, 1983), channel capacity effects should tend to diminish any flow frequency effects on flood hazard frequency (offsetting: opposite signs), rather than amplify them (additive: same signs). Overall, channel capacity effects at least partially offset flow frequency trends at a small majority of sites (55%, Figure 3.13). Among these offsetting sites, increasing channel capacity was twice as common as decreasing channel capacity (149:73 sites), effectively reducing positive flow frequency effects on flood hazard frequency.

If the flow frequency effect is greater than the opposing channel capacity effect at a particular site, one could argue in favour of regime theory, because channel capacity progressively adjusts to the flow frequency trend until changes in flood hazard frequency are eliminated. However, if the channel capacity effect is larger than the opposing flow frequency effect, channel capacity adjustment is disproportionate to the driving streamflow trend. Thus, sites where the channel capacity effect overrides the flow frequency effect, and those where channel capacity and flow frequency effects are additive, do not support regime theory. Such sites are significantly more numerous (63:37, $p<0.001$), suggesting that geomorphic channel adjustments are out-of-phase with or exhibit transient morphological responses to changes in hydrology from the upstream catchment, or that the two effects are completely independent over decadal timescales.

3.3.3. Correctly quantifying total flood hazard frequency

The absence of correlation between channel capacity and flow frequency implies that both trends must be quantified separately if one wishes to determine whether channel capacity may be expected to intensify flow frequency trends, or on the contrary, to reduce them. Calculating flow frequency trends alone, as has been done until now, will not provide an accurate estimate of flood hazard trends.

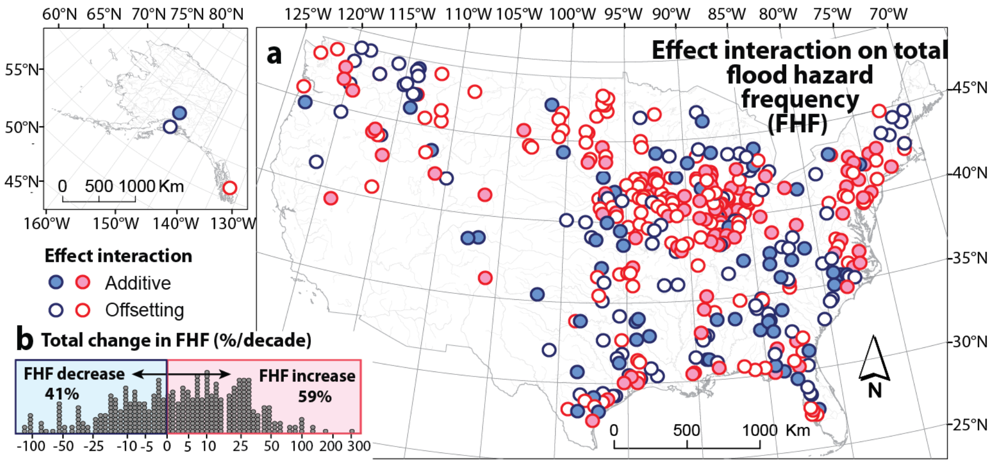


Figure 3.13. Interaction between flow frequency and channel capacity effects on flood hazard frequency. (a) Sites where flow frequency and channel capacity effects reinforce one another and offset one another are indicated by filled and open circles, respectively. Red represents net increases in flood hazard frequency and blue represents net decreases in flood hazard frequency. (b) Statistical distribution of total change in flood hazard frequency, using the same data transformation as in Figure 3.11.

We computed the total change in flood hazard frequency as the sum of channel capacity and flow frequency effects, irrespective of significance levels, and found a statistically significant majority of sites with increasing flood hazard frequency (59% of sites, 235 *versus* 166, p<0.001, Figure 3.13). Whether they contributed to increasing or to decreasing flood hazard frequency, flow frequency effects again were larger than channel capacity effects at 69% of all sites, while channel capacity effects were larger than flow frequency effects at 31% of sites. Therefore, although the total increase in flood hazard (from the sum of channel capacity and flow frequency effects) is primarily driven by flow frequency trends, channel capacity remains an important contributor to flood hazard trends in many locations.

3.4. Conclusions

Flood hazard frequency trends are generally attributed to trends in streamflow, while channel capacity is assumed to be constant. In this chapter, we developed new methods for separately quantifying how trends in both streamflow and channel capacity have affected flood frequency at gaging sites across the USA. Results showed that flood frequency was generally nonstationary, with increasing flood hazard at a statistically significant majority of sites. Channel capacity driven changes in flood hazard were smaller, but more numerous, than those driven by streamflow.

These findings demonstrate that nonstationarity in flood frequency is common and emerges as a result of interacting hydrologic and geomorphic effects. Trends in channel capacity are widespread and they affect flood hazard on a scale that is broadly comparable to flow frequency trends, challenging existing paradigms of flood frequency analysis and channel design (Biggert-Waters Flood Insurance Reform Act, 2012; U.S. Water Resources Council Hydrology Committee, 1981). This means that the relative contributions of flow frequency and channel capacity to flood hazard frequency may have important, unanticipated effects on flood hazard frequency. In particular, in some cases they may act synergistically to exacerbate the rate, extent, and duration with which inundation events occur. These findings suggest that accurately predicting flood hazards, for either flood insurance or river management, requires quantifying future trends in both flow frequency and channel capacity.

This chapter raises questions as to how changing cross-sectional flow area and average cross-sectional flow velocity contribute to shifts in channel capacity. Thus, chapter 4 will focus on how shifts in velocity, width and depth contribute to changes in channel capacity in channels of different sizes and with varying flow regimes, across the United States.

4. Chapter 4. Trends in the cross-sectional velocity, width and depth of alluvial channel flow

4.1. Introduction

Alluvial channels have erodible boundaries that are self-formed by the transport of sediment-laden flow, and thus they adjust their morphology over time to reflect the average volumes of sediment and water that are supplied to them from the upstream basin. Being able to predict the average flow-transporting capacity of river channels is important for engineering, flood risk assessments, water management, climate studies and conservation. Thus, a variety of techniques have been developed for channel design, based on regime, analogy, hydraulic geometry, and analytical approaches (USDA, 2007). In particular, hydraulic geometry (Leopold and Maddock, 1953) is commonly used to estimate how the average flow velocity, the width, and the average flow depth of a static channel cross-section increase with the supplied streamflow, either in one location (termed "at-a-site" hydraulic geometry) or as one travels downstream ("downstream" hydraulic geometry). These relationships can be further refined by accounting for site-specific characteristics, such as the composition of bed and bank material (Knighton, 1974; Kolberg and Howard, 1995) and/or the presence of vegetation (Andrews, 1984; Hey and Thorne, 1986). More recently, remotely-sensed approaches have been developed to predict channel capacity in data-sparse regions using water-surface width obtained from satellite or aerial imagery (Bjerklie et al., 2005; Smith and Pavelsky, 2008), and calibrating the measurements with reach-specific descriptors.

Many of these methods provide good approximations of channel capacity, although their accuracy varies depending on the context and the degree of anthropogenic modifications to the basin flow and sediment supply. However, they are all based on one fundamental assumption: that stream channels are in equilibrium, i.e. are stationary over management timescales, and that the relationships between the geometric components of channel capacity (velocity, width and depth) remain constant over time. Thus, because of the widespread assumption of channel equilibrium, the manner in which channels adjust their capacity, or *how* velocity, width and depth trends contribute to changes in the channel capacity has never been fully investigated, and remains unknown.

4.1.1. What do we know about channel velocity, width and depth adjustments?

The *processes* through which velocity, width and depth trends develop within the channel cross-section are relatively well known. Changes in average cross-sectional flow depth occur as the result of an imbalance between the bedload volumes supplied to the channel and the ability of the stream to evacuate the material. Thus, over time, shifts in net sediment flux produce a change in the sediment volumes stored within the channel, as described by sediment mass balance (Exner, 1920; Paola and Voller, 2005). The entrainment of material from the bed and banks is caused by fluvial erosion within the wetted channel (Shields, 1936) and subaerial processes (soil moisture conditions, vegetative strength) that modify bank cohesion (ASCE, 1998; Thorne, 1982). Progressive widening or narrowing trends develop as a function of the channel's ability (or inability) to evacuate any excess bed material, and the encroachment of any exposed banks and bars by vegetation. Concomitant trends in average cross-sectional streamflow velocity may also develop through changes in grain size (Singer, 2010) and/or vegetation growth/loss (Rutherfurd et al., 2006) that modify the roughness distribution along the bed and banks, and the velocity profile within the wetted channel.

Empirical measurements have shown that, in alluvial channels, the *absolute rates* with which these processes occur – e.g. bank erosion (Brice, 1984; Hooke, 1980) and riverbed aggradation/degradation (Slater and Singer, 2013) – tend to increase with drainage area, stream power (Lawler and Grove, 1999; Nanson and Hickin, 1986) and the variability of high flows (Kochel, 1988; Slater and Singer, 2013). Temporal shifts in the geometry of a river channel depend on the magnitude or effectiveness of individual flow events (Wolman and Miller, 1960) and the time that channels have to recover in-between these events (Wolman and Gerson, 1978). For example, a rapid succession of flow events of moderate magnitude may be more effective in reducing river bank resistance to shear than a single flood of greater magnitude (Knighton, 1973).

A simple metric of flood effectiveness and the frequency of short-term changes in streamflow is flashiness (Baker et al., 2004; Batalla and Vericat, 2009). Streamflow flashiness has been shown to affect the volumes of sediment transport (Tena et al., 2011) and the effective cohesion of river banks, increasing their susceptibility to fail (Simon et al., 2000). Here we seek to clarify the roles of these two major geomorphic controls, i.e. the capacity of channels and the flashiness of the flow regime, on the rates of change in alluvial channel geometry.

4.1.2. Limitations of existing methods for quantifying channel trends

Changes in cross-sectional channel capacity have traditionally been assessed using the specific gage (or equal discharge) approach (Blench, 1969), which assesses changes in water levels (stage) associated with a pre-defined discharge over time. Plots of stage *versus* discharge (Biedenharn and Watson, 1997; Stover and Montgomery, 2001) provide a simple visualisation of changes in the channel capacity over time (chapter 1, Figure 1.9). If the channel capacity has decreased through narrowing of the banks, aggradation of the riverbed, or a reduction in mean cross-sectional velocity, the stage will increase for the same discharge. Likewise, if the channel capacity has increased through widening, degradation, and/or an increase in the mean cross-sectional velocity, the stage will decrease for the same discharge.

However, the specific gage approach cannot be used to separate the causes of changes in channel capacity, i.e. trends in the average velocity, width, or average depth of the cross-sectional flow. Attempts to quantify changes in channel width using this method (Allred and Schmidt, 1999; Pinter and Heine, 2005) are problematic. For example, consider a trapezoidal channel where the bed has degraded and the banks angles have remained consistent relative to the bed (Figure 4.1a). If the width is measured for a constant value of flow, then the channel cross-section will appear to have narrowed, although the change in flow surface width is in fact due to the downward shift in the flow within the cross-section (Figure 4.1a). The change in channel depth (Pinter and Heine, 2005) (*h*) for this equal discharge will also be miscalculated (Figure 4.1a).

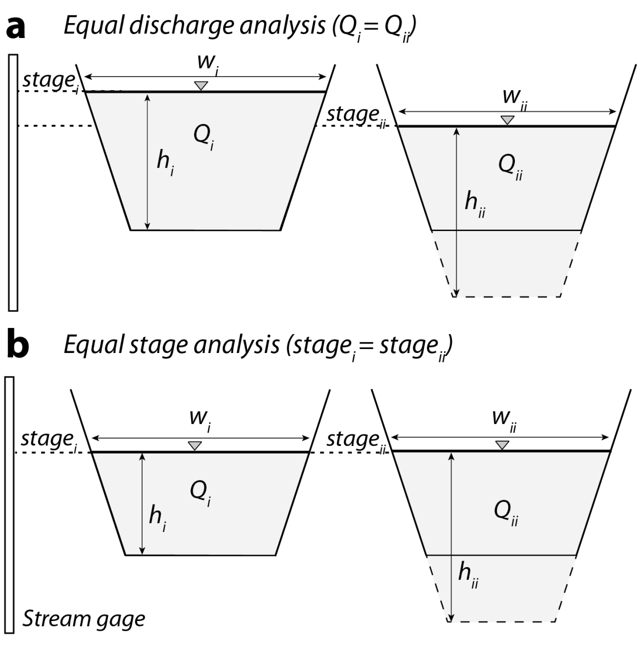


Figure 4.1. Schematic comparing two approaches for the evaluation of shifts in channel capacity: (a) the equal discharge approach, in which channel form is evaluated for a given discharge (Q_i=Q_{ii}); and (b) the equal stage approach, where channel form is evaluated for a given stage ($stage_i$=$stage_{ii}$).

A more accurate approach consists of using the field measurements obtained for an equal value of stage, or narrow range of stage values. For example, if the cross-sectional channel measurements of width, average flow depth, and average flow velocity are measured beneath a fixed upper boundary, as in Figure 4.1b, calculated temporal trends in these measurements will be much more accurate. The principal limitation of the two methods that we have just outlined is that they only use a small fraction of historical channel measurements to quantify changes in channel capacity – namely, the measurements that were made at a given value of discharge (Figure 4.1a) or at a given level of stage (Figure 4.1b).

An approach that does not require 'throwing out' valuable field measurements consists of removing the influence of differences in measured stage by using the residuals of the regression (rating curve) relationship between discharge and stage (James, 1997, 1991). Rating curves relating stage and channel characteristics (discharge, velocity, width, or depth) have historically been fit using power (Leopold and Maddock, 1953) or polynomial (Richards, 1976) relationships. The regression residuals (i.e. the observed minus the predicted values of the channel characteristics) can then be used to evaluate changes in the rating curve relationship over time (James, 1991). This approach has the precision of a fixed stage approach (as in Figure 4.1b) while also including a much wider range of measurements. The validity of the method requires (i) a good fit of the regression relationship, and (ii) approximate equivalence of the residuals for all levels of stage (i.e. that there is no drift in the relationship). However, if a poor regression curve is used, or if discharge measurements are selected for very different levels (from the lowest to the highest stages), there may be considerable variance about the regression relationship, particularly at the tail ends of the regression line. Thus, provided they are adapted, such methods can be used to assess how channel capacity adjusts over time in response to longitudinal divergences in sediment flux and adjustments in boundary roughness.

The aims of this chapter are to assess how velocity, width and depth trends vary in channels of different sizes and with varying flow regimes; to evaluate whether they tend to display same or opposite signs (positive/negative), thus increasing/decreasing channel capacity in unison, or counterbalancing one another; and whether they contribute equally to shifts in channel capacity. This understanding will provide better insight for managers and engineers into how river channels evolve over decadal timescales.

4.2. Methods

At more than 7,000 active stream gages across the USA, the USGS use stage-discharge rating curves to estimate streamflow volumes based on the measured stage. Manual field measurements are thus made of the channel dimensions to calculate the amount of discharge that is carried within the stream cross-section as:

$$Q = A \cdot U \quad \text{or} \quad Q = A \cdot w \cdot h \tag{4.1}$$

where A is the area, U is the average velocity, w is the channel width, and h is the average depth of the cross-sectional streamflow (Carter and Davidian, 1968). The measurements are made repeatedly to maintain accurate ratings, as channel geometry may shift over time. The archive of historical streamflow measurements is publicly accessible online (U.S. Geological Survey, 2015b) and can be used to evaluate how alluvial channel geometry, i.e. the average flow velocity, the width, and the average flow depth of a river channel cross-section have evolved.

Before quantifying trends in channel geometry, we must first filter out any measurements that have not been made consistently in the same location over time.

4.2.1. Site and measurement selection criteria

In chapter 3, the analysis of stream channel changes was limited to stream gages where flood stage had already been measured by the USGS, so that shifts in channel capacity and flow frequency could be compared at a defined level of flow. However, such stations with defined values of flood stage are limited in number, thus the site-selection and filtering procedures were adapted here in order to be able to quantify changes in streamflow velocity, width and depth at a larger number of sites. Our filtering procedures described below are similar to those previously discussed in chapter 3, but are recalled to highlight differences in methods between the two chapters.

First, a total of 6846 annual USGS water data reports (U.S. Geological Survey, 2014f) were manually verified for any mention of hard structures at the stream gage such as weirs or permanent controls, which prevent or limit the channel from freely adjusting. Sites with such structures were not used in subsequent analysis (465 were detected). The reports were also scrutinized for any mention of changes in measurement location or datum. We systematically noted the latest year in which any change was made. As the exact date of change in location/datum is not always provided in the reports, we conservatively removed any channel measurements made before or during that year from the analysis.

Manual field measurements of flow width, cross-sectional flow area, and average cross-sectional flow velocity were then downloaded for all of the remaining sites between 1 January 1950 and 31 December 2013.

Individual 'manual' flow measurements (U.S. Geological Survey, 2014c) were filtered as follows. We removed any measurements made in icy conditions (indicated by the data columns *meas_type* and *control_type_cd*) which may affect the channel geometry. If any one of the Q, A, U, or w measurements had a negative, zero, or missing value on a given date, we removed the entire collection of measurements (Q, A, U, and w) made on that day. Measurement inaccuracies were verified by calculating $Q/(A*U)$ and removing measurements where this ratio was not equal to 1, within a range of ±5%. This threshold is more relaxed than the strict ±1% threshold used in chapter 3, as field measurements are themselves within ±5% accuracy. Finally, we discarded any measurements that were made at any nonzero distance from the gage (indicated in the data columns *chan_loc_cd* and *chan_loc_dist*).

Because measured flood stage values were not available for all of the selected sites (as discussed above), we defined the level at which we would assess changes in channel geometry based on the statistical distribution of the stage measurements. We selected the median value of all stage measurements (G_{50}) as our reference level to evaluate changes in the channel geometry at average, sub-bankfull levels of flow.

Since the majority of field measurements are not made precisely at G_{50}, we included a range of manual field measurements that were made within the 25th and the 75th percentiles of the distribution (G_{25} and G_{75}, Figure 4.2 and Figure 4.3). This range is wide enough to encompass a large number of manual field measurements while excluding both low flows, which capture changes occurring close to the stream bed, and high flows, which may extend well into the floodplain and are irrelevant for quantifying within-channel change.

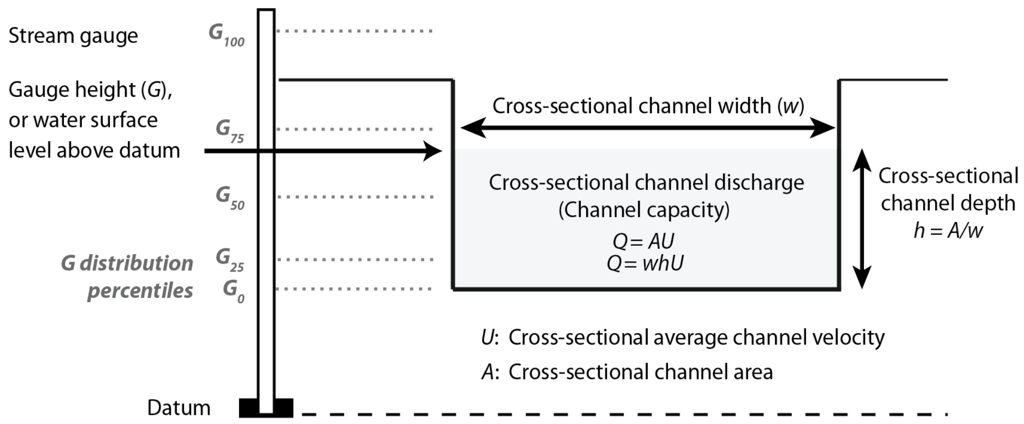


Figure 4.2. Schematic channel cross-section indicating distribution of manual field measurements of cross-sectional discharge (Q), cross-sectional flow area (A), average cross-sectional flow velocity (U), channel width (w), and average flow depth (h), for different values of stage (G). The USGS generally try to make field measurements that are representative of the full range of stage (i.e. at both low and high-flow conditions, to obtain a complete stage-discharge rating curve, as in Figure 4.3). Although the manual field measurements made between G_{25} and G_{75} are typically located within the active channel, as indicated here, the precise distribution of stage percentiles (indicated by dotted horizontal lines) will vary slightly for each gaging site depending on the flow conditions when each channel measurement was made. G_{50} indicates the median value of the stage distribution.

These filtering steps allowed us to exclude any measurements that were not directly relevant to changes in channel capacity at the median stage (Figure 4.3). Only sites with a minimum of 10 cross-sectional channel measurements between G_{25} and G_{75}, spanning a period of at least 20 years, were retained.

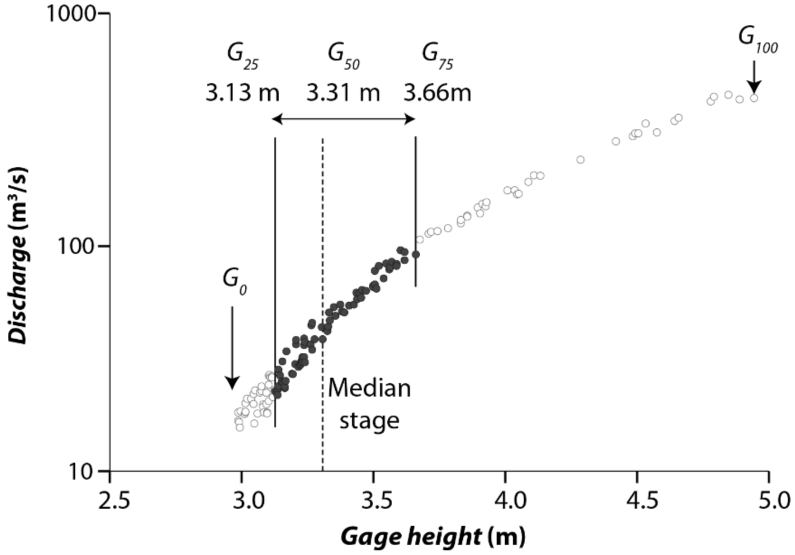


Figure 4.3. Example of measurement selection between the 25th and 75th percentiles of the gage height (G_{25}-G_{75}), at USGS site 14187200, South Santiam River near Foster, OR. An idealized distribution of stage within a schematic channel cross section is indicated in Figure 4.2.

Following the channel measurement filtering steps, the scatterplots of *Q, A, U, w* and *h versus G* were plotted and visually cross-verified (e.g. Figure 4.3) to detect sites where the measurements made between G_{25} and G_{75} might have been made in different gaging locations. Despite the above-mentioned indications regarding measurement location, precise measurement locations are typically missing from the data files for the majority of measurements. Manual field measurements are often made at a distance from the principal gaging site, which is not an issue if the measurement location is consistent over time. However, if the measurement location is variable, computed trends in channel capacity will be incorrect. It is therefore vital that such measurements are identified and excluded. Any sites with visible differences in measurement location were therefore systematically removed from the analysis.

In contrast with chapter 3, we did not carry out any manual filtering of *individual* measurements: we retained only the sites where measurement location appeared consistent for all measurements. [Note that that in chapter 3 we were constrained by the relatively 'small' number of sites that had flood stage values and could not afford to discard sites with inconsistent measurement location, so we chose to filter inconsistent measurements manually. Here, the number of sites with visually consistent measurement locations was substantial, and thus no such filtering was necessary].

Of the initial ~6000 sites, a total of 973 sites were retained after verifying that each site had at least a minimum of 10 cross-sectional channel measurements between G_{25} and G_{75}, that the measurements spanned a period of at least 20 years, and that the plots showed no obvious signs of multiple measurement location and/or changes in datum that might not have been noted in annual water data reports. For these 973 sites, the mean number of Q, A, U, w and h measurements per site was 125, and the mean temporal range of these measurements was 35 years.

4.2.1. Loess curve fitting for residual analysis

Since the retained manual field measurements are not made solely at G_{50} but for a range of stage values between G_{25} and G_{75}, we use a procedure that estimates what Q, U, w and h would have been at G_{50} at the time when each manual field measurement was made. As explained by Helsel and Hirsch (1993), in cases where several variables (e.g., time and G) may affect the magnitude of a response variable (here, Q, U, w or h), the effects of the extraneous explanatory variable (G) may be removed by fitting a smooth curve to its relationship with the response variable (here, a curve relating Q to G, U to G, w to G, or h to G) and using the residuals from this curve in subsequent analyses. This procedure corrects for changes in G without assuming that the relationship has any particular functional form.

To determine how the channel dimensions have changed over time, we developed rating curves to the manual field measurements using a Locally weighted Scatterplot Smoothing (Loess) procedure (Cleveland, 1979). Loess produces a smooth nonparametric curve through the data (e.g. Figure 4.4), and downweights the influence of outliers. The degree of smoothing is controlled by a parameter termed α which ranges from 0 to 1 and determines the proportion of data that is used to fit each local polynomial.

To implement Loess, the manual field measurements were first converted to metric units and scaled by their natural logarithms to smooth any variability in the data. Using the R statistical programming language (Ripley, 2014), we used Loess to develop smooth ratings between the natural logarithms of the manual field measurements of discharge (Q), cross sectional flow area (A), average cross-sectional flow velocity (U), width (w), average cross-sectional flow depth (h), and stage (G). An α fitting parameter of 0.75 was used, as in chapter 3, as it produced a good fit to the data (see Figure 4.4).

4.2.2. Time-averaged values at median stage

Time-averaged values of channel discharge, cross-sectional area, average flow velocity, width, and average flow depth were extracted at the point where the Loess curves intersect the median stage (G_{50}), using the predict.loess function from the R statistical programming language (Ripley, 2014). These fixed values, termed $\overline{Q_{50}}$ (m^3/s), $\overline{A_{50}}$ (m^2), $\overline{U_{50}}$ (m/s), $\overline{w_{50}}$ (m), and $\overline{h_{50}}$ (m), represent the average channel dimensions over the period when the measurements were made at G_{50}, which is typically situated in the upper-half of the alluvial channel (Figure 4.4). $\overline{Q_{50}}$ corresponds to the *average capacity of the channel at median stage*, and is thus referred to as channel capacity in the rest of the chapter. The estimated values of $\overline{Q_{50}}$, $\overline{U_{50}}$, $\overline{w_{50}}$ and $\overline{h_{50}}$ are used to calculate trends in the cross-sectional discharge, average cross-sectional flow velocity, width, and average cross-sectional flow depth at G_{50} as follows.

To remove the influence of differences in gage height on the relationship between *Q*, *U*, *w*, *h*, and time, we computed the residuals (indicated by a hat above the variable name and the subscript ε) to the Loess curves as:

$$\ln\left(\hat{Q}_{\varepsilon_i}\right) = \ln\left(Q_i\right) - \ln\left(\overline{Q_i}\right) \tag{4.2.a}$$

$$\ln\left(\hat{U}_{\varepsilon_i}\right) = \ln\left(U_i\right) - \ln\left(\overline{U_i}\right) \tag{4.2.b}$$

$$\ln\left(\hat{w}_{\varepsilon_i}\right) = \ln\left(w_i\right) - \ln\left(\overline{w_i}\right) \tag{4.2.c}$$

$$\ln\left(\hat{h}_{\varepsilon_i}\right) = \ln\left(h_i\right) - \ln\left(\overline{h_i}\right) \tag{4.2.d}$$

where $\ln\left(Q_i\right)$, $\ln\left(U_i\right)$, $\ln\left(w_i\right)$, and $\ln\left(h_i\right)$ are the natural logarithms of the observed manual field measurements of discharge, velocity, width and depth (dark grey circles on the left of Figure 4.4), and $\ln\left(\overline{Q_i}\right), \ln\left(\overline{U_i}\right), \ln\left(\overline{w_i}\right)$, and $\ln\left(\overline{h_i}\right)$ are the estimated values from the Loess curve, obtained using the predict.loess function from the R statistical programming language (Ripley, 2014).

Thus, assuming that the Loess curves represent the time-averaged values of ln(*Q*), ln(*U*), ln(*w*) and ln(*h*), the values of the corresponding residuals (positive or negative) indicate whether each manual field measurement of ln(*Q*), ln(*U*), ln(*w*) or ln(*h*) is less than or greater than the time-averaged value for that level of stage over the entire period (Figure 4.4).

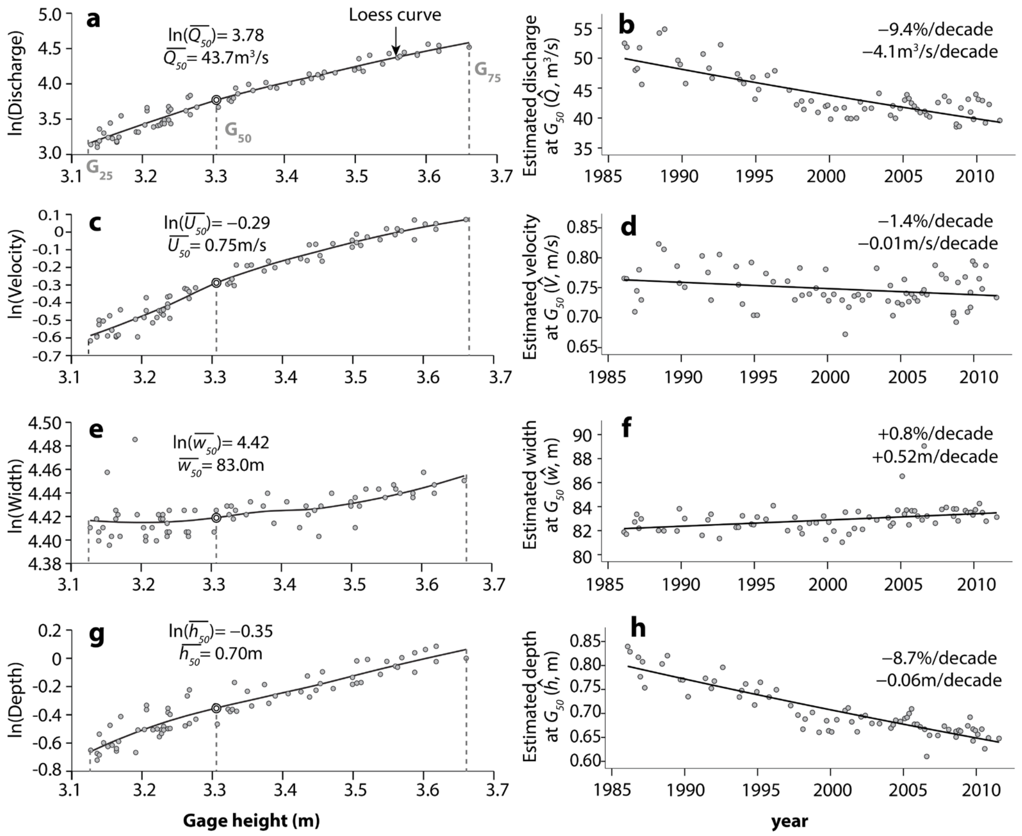


*Figure 4.4. Calculating trends in cross-sectional discharge (Q), cross-sectional average flow velocity (U), width (w), and cross-sectional average flow depth (h) at the South Santiam River near Foster, Oregon. In the **left panels**, grey Loess curves fit the log-transformed measurements of (a) Q, (c) U, (e) h, and (g) w versus Gage height (m). Grey circles represent manual field measurements that were selected within the 25th and 75th percentiles of the stage distribution (G_{25} and G_{75}, see Figure 4.2). Stage values of G_{25}, G_{50} and G_{75} for the South Santiam River are represented as vertical dashed grey lines. The interpolated values of $\overline{Q_{50}}$, $\overline{U_{50}}$, $\overline{w_{50}}$ and $\overline{h_{50}}$ are indicated by the circle on the Loess curve at G_{50}. Residuals are measured as the vertical distance between each grey circle and the Loess rating curve (not depicted here), and indicate how each measurement deviates from the average value on the Loess rating curve, for the corresponding stage (see equations 4.2a to 4.2d). Assuming that the residuals are representative of the temporal changes at G_{50}, we calculate the estimated values of cross-sectional Q, U, h, and w at G_{50} at the time of each measurement*

as the sum of $\overline{Q_{50}}$, $\overline{U_{50}}$, $\overline{w_{50}}$, *or* $\overline{h_{50}}$ *and each individual residual (see equations 4.3a to 4.3d). The grey curves in the* ***right panels*** *indicate the mean-unbiased exponential IRLS temporal trends in the estimated values of (b)* $\hat{Q}$ *, (d)* $\hat{U}$ *, (f)* $\hat{w}$ *and (h)* $\hat{h}$ *, which were obtained as the sum of the time-averaged measurements at* G_{50} *(*$\overline{Q_{50}}$, $\overline{U_{50}}$, $\overline{w_{50}}$ *, and* $\overline{h_{50}}$ *) and the residuals to the Loess curves. Note: the curves are exponential, but the curvature is indistinct for many sites due to the scatter in the underlying data.*

Under the premise that the temporal trend of residuals at G_{50} (indicated by dashed vertical line on left of Figure 4.4) is the same as that of the residuals over the rest of the curve as a whole, one can assume that the temporal trend in the residuals at G_{50} is the same as the temporal changes in the residuals over the rest of the curve as a whole. Time-changing values of *Q*, *U*, *w* and *h* were then estimated at G_{50} as the sum of the time-averaged value at G_{50} and the value of each residual:

$$\ln\left(\hat{Q}\right) = \ln\left(\overline{Q_{50}}\right) + \ln\left(\hat{Q}_{\varepsilon_i}\right) \quad (4.3.a)$$

$$\ln\left(\hat{U}\right) = \ln\left(\overline{U_{50}}\right) + \ln\left(\hat{U}_{\varepsilon_i}\right) \quad (4.3.b)$$

$$\ln\left(\hat{w}\right) = \ln\left(\overline{w_{50}}\right) + \ln\left(\hat{w}_{\varepsilon_i}\right) \quad (4.3.c)$$

$$\ln\left(\hat{h}\right) = \ln\left(\overline{h_{50}}\right) + \ln\left(\hat{h}_{\varepsilon_i}\right) \quad (4.3.d)$$

The resulting values are the logarithmic estimates of *Q*, *A*, *U*, *w* and *h* that would be required, at the time of each manual field measurement, to attain G_{50}.

4.2.3. Trend fitting

The trends in discharge, velocity, area, width and depth at G_{50} may be affected by errors or undetected variations in manual field measurements, so we used an iteratively reweighted least squares (IRLS) procedure to limit the influence of $\hat{Q}$, $\hat{U}$, $\hat{w}$ and $\hat{h}$ outliers on trend estimates (Holland and

Welsch, 1977). IRLS is an iterative procedure that is typically used to mitigate the influence of outliers in a linear model. Within the IRLS routine, a Cauchy weighting function (Holland and Welsch, 1977) is applied to the residuals from the fitted function to minimise the influence of outliers, as:

$$w_i = \frac{1}{1 + \left(\frac{a_i}{3.536MAR}\right)^2} \tag{4.4}$$

where a_i is the residual corresponding to an individual point, and *MAR* is the median absolute residual. The trend in estimated values of $\hat{Q}$, $\hat{U}$, $\hat{w}$ and $\hat{h}$ is computed using an IRLS trend with an exponential unbiased mean form:

$$\frac{\hat{\alpha}_{\varepsilon_i}}{wt.mean(\hat{\alpha}_{\varepsilon_i})} = \frac{\exp(r\Delta t)}{wt.mean(\exp(r\Delta t))} \tag{4.5}$$

where $\hat{\alpha}_{\varepsilon_i}$ is the estimate of $\hat{Q}$, $\hat{U}$, $\hat{w}$ or $\hat{h}$ corresponding to an individual point, $wt.mean(\hat{\alpha}_{\varepsilon_i})$ is the weighted mean of the estimates of $\hat{\alpha}_{\varepsilon_i}$ using the IRLS weights for each point; r is the fractional change in $\hat{\alpha}_{\varepsilon_i}$ per unit of time; and $\Delta t =$ date–mean(date), where mean(date) is the midpoint of the time series. Because the outliers are down-weighted, the means must be weighted (i.e. calculated based on the weights that are given to each point in the fit) and updated for each iteration of the IRLS. Trends in velocity, width, and depth, were computed in percent per decade (r times 100, with Δt expressed in decades), so that they could be compared directly to one another and across rivers of varying size. Figure 4.4 illustrates the computed trends in $\hat{Q}$, $\hat{U}$, $\hat{w}$ and $\hat{h}$ for the South Santiam river near Foster, Oregon (right panels).

4.2.4. Comparing trends in velocity, width, and depth

To compare percentage changes in velocity, width and depth, equation 4.1 can be transformed in natural logarithms as:

$$\ln Q = \ln U + \ln w + \ln h \tag{4.6.a}$$

and taking the derivative with respect to time yields:

$$\frac{d(\ln Q)}{dt} = \frac{d(\ln U)}{dt} + \frac{d(\ln w)}{dt} + \frac{d(\ln h)}{dt} \tag{4.6.b}$$

The change in cross-sectional channel capacity (*Q*) can thus be expressed as:

$$\frac{d(\ln Q)}{dt} = \frac{dQ}{dt} / Q \tag{4.6.c}$$

which appears in terms of percentage change as:

$$\frac{dQ}{dt} / Q \cdot 100 = \left(\frac{dU}{dt} / U \cdot 100 \right) + \left(\frac{dw}{dt} / w \cdot 100 \right) + \left(\frac{dh}{dt} / h \cdot 100 \right) \tag{4.6.d}$$

allowing for a small margin of error (±5%, according to Rantz (1982b)) due to inaccuracies in manual stream measurements. Thus, the trend in channel capacity (*Q*), in percent per decade, is approximately equal to the sum of computed trends in velocity, width, and depth in percent per decade, following equation 4.6d (Figure 4.5).

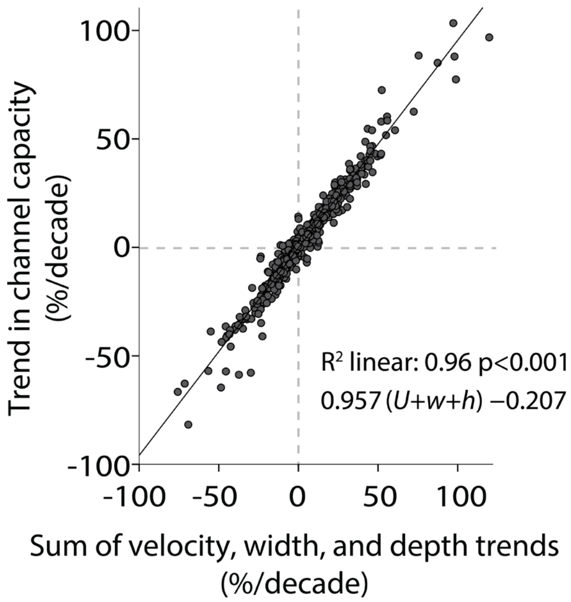


Figure 4.5. Scaling of the trend in discharge at median stage (noted here as "channel capacity") versus the sum of the trends

in cross-sectional average velocity, width, and average flow depth at median stage, all in %/decade (indicated as U+w+h in the equation). The relationship shows good agreement between the measured trend in Q and the sum of trends in U, w and h.

4.2.5. Flow regime

To compare trends in average velocity, width, and average depth of cross-sectional channel flow across different flow regimes, we use the Richards-Baker flashiness index (R-B index (Baker et al., 2004)), which was developed to characterise the continuum in flow regime flashiness, ranging from ultra-stable groundwater-based streams to flashy streams with frequent flood peaks and high surface runoff. The R-B index is calculated over a given time period (commonly one year) as the ratio of the sum of absolute daily changes in streamflow (the "pathlength") to the sum of total daily discharge. For daily streamflow values, which were used here, it is written as:

$$\text{R-B index} = \frac{\sum_{i=1}^{n} 0.5\left(\left|q_{i+1} - q_i\right| + \left|q_i - q_{i-1}\right|\right)}{\sum_{i=1}^{n} q_i} \tag{4.7}$$

where q_i is one mean daily flow, and n is the total number of continuous flow days in the year. The pathlength is centred over the same time period as the mean daily flow. Pathlength and corresponding daily values were only retained for continuous daily flow measurements (i.e. when there was no gap in the data between q_{i-1}, q_i, and q_{i+1}). Annual R-B values were obtained only for years with at least 350 such continuous flow days, to remove any incomplete water years, which do not estimate the R-B index accurately. The mean R-B index is calculated as the mean of all annual R-B index values, over a minimum of 10 complete water years between 1950 and 2013. Figure 4.6 illustrates the difference between a flashy site with a high R-B index and a stable site with a low R-B index.

To assess whether the magnitude and direction of trends in velocity, width, and depth vary between stream gaging sites where the flow regime has been relatively unmodified by anthropogenic influences and heavily-modified sites, we used the Streamflow Reference Classification from the GAGES II dataset (Falcone, 2011, described in chapter 2), which classifies sites as being in reference condition *versus* non-reference conditions, and which was available for 97% of all sites.

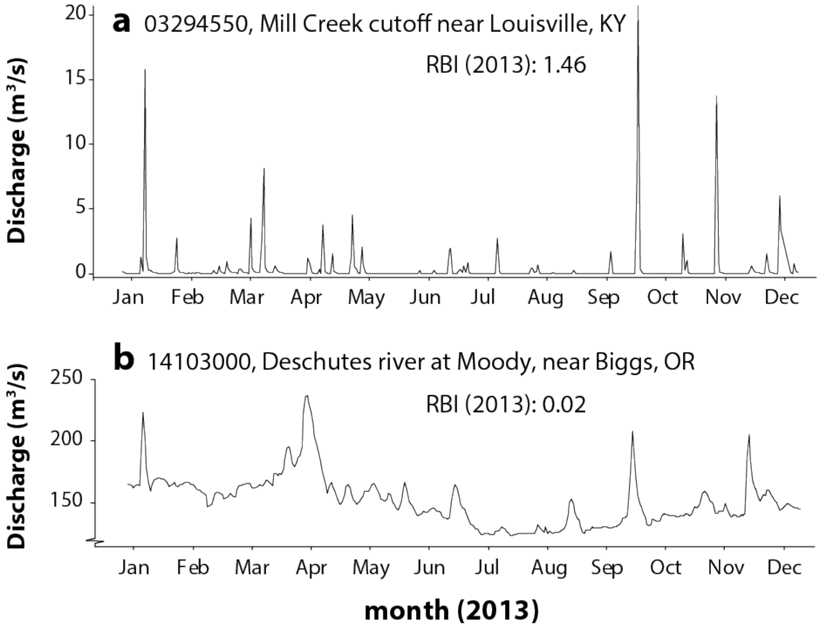


Figure 4.6. Comparison of annual hydrographs for (a) a flashy stream, USGS site 03294550, Mill Creek cutoff near Louisville, Kentucky (for 2013: RBI=1.46, annual pathlength= 206 m^3, Annual Q=142 m^3); (b) a stable stream, USGS site 14103000, Deschutes river at Moody, near Biggs, Oregon (for 2013, RBFI=0.02, annual pathlength= 1173 m^3, annual Q=55254 m^3).

4.2.6. Final dataset and statistics

After all site-selection and filtering procedures described above, 973 gaging sites were retained, spanning a large range of stream sizes and flow regimes across the United States. Channel capacity ranged from 0.01 m^3/s (0.8 m wide) for the North Fork Kings Canyon Creek near Carson City, Nevada, to 4,529

m^3/s (499 m wide) for the Yukon River at Eagle, Alaska. Drainage area ranges from 4 km^2 for the Michigan River near Cameron Pass, Colorado, to over 1,290,000 km^2 for the Missouri River at Glasgow, Missouri. Elevation ranges from -3.25 mASL for Howard Creek near Sarasota, Florida, to 3,179 mASL for Bobtail Creek near Jones Pass, Colorado. Finally, the mean annual R-B index ranges from 0.02 for the Yellowstone River at Yellowstone Lake Outlet, Yellowstone National Park, to 1.34 for the very flashy Mill Creek cutoff near Louisville, Kentucky.

The significance ($p<0.05$) and magnitudes of these trends in average velocity, width, and average depth of cross-sectional flow (hereafter referred to as "velocity, width, and depth" were investigated at all 973 sites, as described above. To determine whether these trends were affected by any climatic or anthropogenic influences, we assessed whether the proportions of increasing versus decreasing trends differed between sites with reference *versus* non-reference (anthropogenically modified) flow conditions using the GAGES II Streamflow Reference Classification. All statistical tests described hereafter, including proportions of increasing/decreasing sites, additive/offsetting sites, and binomial sign tests, were carried out using all of the computed trends (both significant and non-significant). Relationships between magnitude of channel trends, channel capacity, and flow regime were assessed using only the significant trends in velocity, width, and depth (to determine whether there was a relationship between these variables and the development of significant trends). All regression relationships were evaluated by fitting least squares linear, logarithmic, power, and exponential functions (with two constants), and we reported only the function with the highest R^2.

4.3. Results

Significant ($p<0.05$) trends in velocity, width and depth of the cross-sectional flow were found at 67%, 68% and 67% of sites, respectively. These percentages are remarkably consistent with the proportion of sites displaying significant trends in bed elevation in chapter 2 (68%), even though different sites and different trend detection methods were employed. The proportion of significant trends in velocity, width and depth is also higher than that of significant trends in flood stage capacity presented in chapter 3 (47%). The latter discrepancy can be attributed to the fact that in chapter 3, trends were only assessed at flood stage, which is at the upper (tail) end of the distribution (see Figure 3.4). Significant trends observed at high flow stages may develop over longer time periods than those observed at low flow stages, as only rare, catastrophic events are capable of remodelling river channels at flood stages.

4.3.1. Direction of, and interaction among, trends in velocity, width and depth

We found that significant proportions of channel trends exhibit decreasing velocity (55% of sites, $p<0.001$), widening (61% of sites, $p<0.001$) and bed-degrading trends (55% of sites, $p=0.002$) (Figure 4.7). In other words, for the majority of sites, the flow has slowed down and the channel cross-sections are eroding. These results are also consistent with findings from chapter 2, where 62% of sites were degrading [note that this proportion was only computed for sites with significant trends in chapter 2, so the proportion may be different than it would have been if measured across all sites]. There was not a statistically significant difference in the proportion of increasing/decreasing trends for velocity, width, or depth, between reference and non-reference sites. In other words, the measured trends in channel geometry cannot be clearly attributed to human influences or to a climatic signal.

These proportions of increasing *versus* decreasing trends raise the question of whether trends in velocity, width, and depth tend to develop independently (i.e. display opposite signs), or whether they co-vary (same signs) to accommodate larger/smaller volumes of flow/sediment over time. We found that width and depth trends displayed a weak positive correlation (Spearman's ρ=0.20, p<0.001), that velocity/width trends were not correlated (p=0.53), and that velocity/depth trends only very weakly correlated (ρ=0.085, p=0.008).

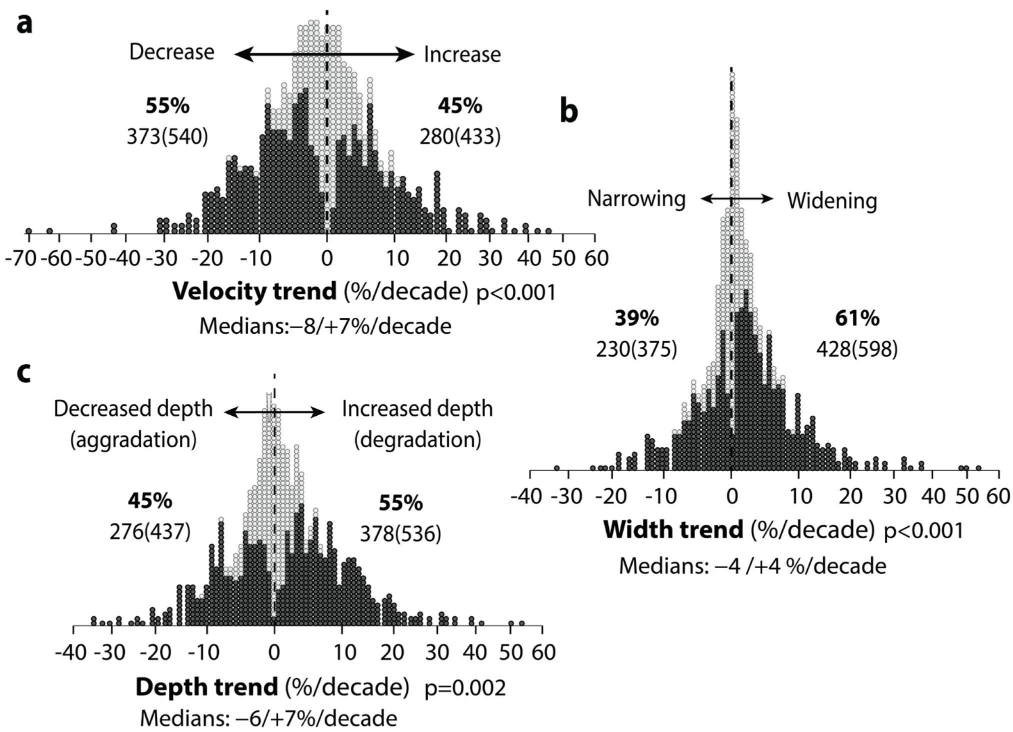


Figure 4.7. Proportion of sites with increasing versus decreasing trends in (a) velocity, (b) width, and (c) depth. Dashed vertical black line separates positive and negative trends. Black filled circles indicate significant trends (p<0.05) and hollow grey circles non-significant trends. Axes were power-transformed to moderate the leptokurtic (peaked) form of the distribution. Median trends displayed in the figure are for significant trends only. Average trends in channel geometry across both significant and non significant sites were of –5.1/+4.7 %/decade for velocity, –2.3/+2.9 %/decade for width, –3.4/+4.4 %/decade for depth, and -5.5/+6.5 %/decade for streamflow, at the median stage (G_{50}).

Overall, these relationships suggest that width and depth often increase/decrease together, but that their direction is relatively independent from the direction of trends in average flow velocity, and that it is challenging to determine whether the flow area (width/depth) is adjusting to changes in the flow velocity or vice-versa.

To test the relationships between trends in width/depth and velocity further, each of the 973 sites was labelled as either (i) additive, i.e. where velocity, width, and depth all increase/decrease simultaneously so the channel carries a larger/smaller volume of streamflow; or (ii) offsetting, where at least one of the velocity, width, or depth trends displays an opposite sign to the others, thus maintaining a more stable channel form.

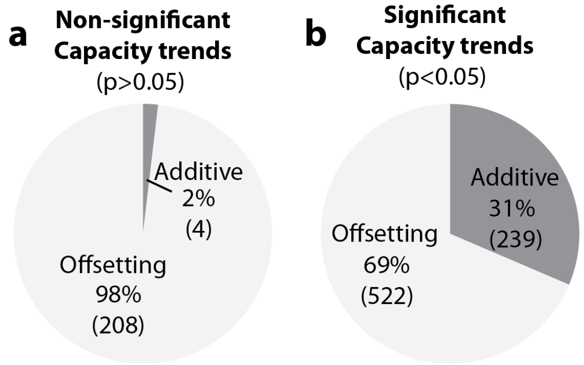


Figure 4.8. Proportion of additive versus offsetting sites in locations with (a) non-significant and (b) significant channel capacity trends. Additive indicates sites where trends in velocity, width, and depth have the same sign (i.e. are all positive or all negative) and offsetting indicates sites where at least one trend has an opposite sign to the others.

In sites where channel capacity was in equilibrium (i.e. non-significant channel capacity shifts), the vast majority (98%) of sites were offsetting (Figure 4.8a); while at sites where channel capacity trends were significant, the proportion of offsetting sites was smaller, but still accounted for >2/3 of all sites (Figure 4.8b). These results imply that most of the time, velocity, width, and depth trends do tend to offset one another. Even when trends in channel capacity (*Q*) are significant, they tend to be caused by just one or two of the three components of channel capacity (velocity, width, or depth) rather than all three (Figure 4.8b).

What determines whether velocity, width, and depth trends develop in the same (additive) or opposite (offsetting) directions? We find that offsetting sites tend to have significantly larger channel capacities (Figure 4.9a), and more stable flow regimes (lower R-B index, Figure 4.9b) than additive sites. Thus, in small and flashy streams with high surface runoff, the velocity, width, and depth are more likely to increase/decrease together (same direction) to accommodate a larger or smaller volume of flow. In larger streams with more stable flood flows, the velocity, width, and depth trends have a greater tendency to display opposite signs (i.e. narrow and degrade, or widen and aggrade), so the overall channel capacity remains in equilibrium. We would expect to find channel equilibrium (i.e. no trend in the cross-sectional discharge) in channels where small trends in velocity, width and depth balance one another out in terms of their influence on the channel capacity. In contrast, progressive increases or decreases in discharge may occur when at least one of the three components of capacity (velocity, width or depth) is increasing or decreasing substantially more than the others, over a prolonged period of time, or in locations where all components are increasing/decreasing in sync.

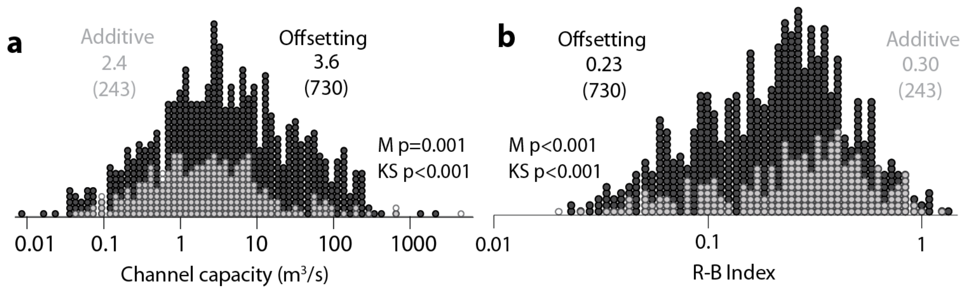


Figure 4.9. Distribution of (a) channel capacity and (b) R-B index values split by groups of additive (white circles) versus offsetting (black circles) sites. Significance levels are indicated by the letter M for the independent samples Medians test, and KS for the Kolmogorov-Smirnov test. Distribution medians are indicated beneath offsetting/additive distribution labels, and the number of sites in each group is indicated in parentheses.

4.3.2. What affects trend magnitude?

Since negative and positive channel trends can develop through different processes, we separated the velocity, width, and depth trends by their signs (−/+) to observe their respective magnitudes across all sites. The average magnitudes of significant trends were −8/+7 % per decade (or, in dimensional units, −0.03/+0.03 m/s per decade) for velocity, −4/4 % per decade (−0.7/+0.8 m per decade) for width, and −6/+7 % per decade (−30/+30 mm per decade) for depth. The dimensional depth trends were comparable to those measured in chapter 2 (~50 mm per decade), suggesting that average trend magnitudes are relatively consistent across different samples of USGS sites. Therefore, on average, changes in channel capacity are principally controlled by velocity trends, followed by depth trends, and the least by width trends (Figure 4.10).

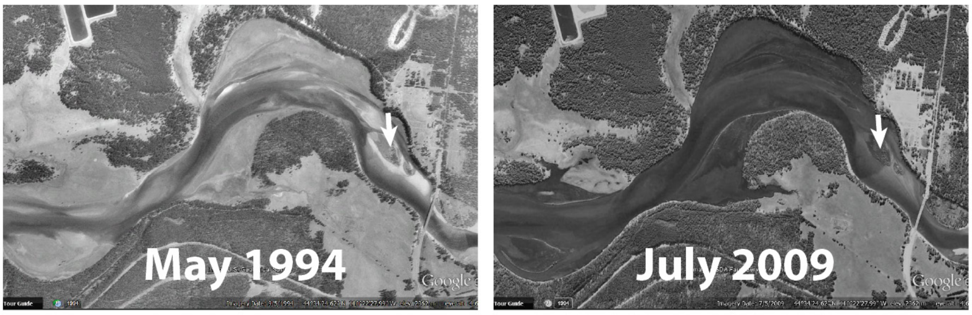


Figure 4.10. Aerial imagery illustrating changes in cross-sectional average flow velocity at the Yellowstone River at Yellowstone Lake Outlet, Yellowstone national Park, USGS site number 06186500. Decreases in flow velocity (−3%/decade, or −0.02m/s/decade between 1975 and 2008) contributed to the overall decrease in channel capacity (−4%/decade, or −1.25m^3/s/decade) far more than the decreases in channel depth (−0.9%/decade or −0.01m/decade) or width (−0.2%/decade, or −0.3m/decade). The imagery suggests that in-stream vegetation growth accounts for some of the change, as the islands have become more densely vegetated (as indicated by white arrow), although field work would be required to determine the exact causes of velocity decrease. Seemingly small changes such as these can have much larger effects on flood hazard frequency, as

shown in chapter 3. Images courtesy of the USGS and USDA Farm Service Agency, via Google Earth.

Velocity, width, and depth trends were tested against channel capacity and R-B index to assess whether channel size and flow regime were correlated with trend magnitude. We found a strong negative relationship between magnitude of velocity, width and depth trends and channel capacity, so trend magnitude (positive or negative) gradually decreases as the channel capacity increases (Figure 4.11).

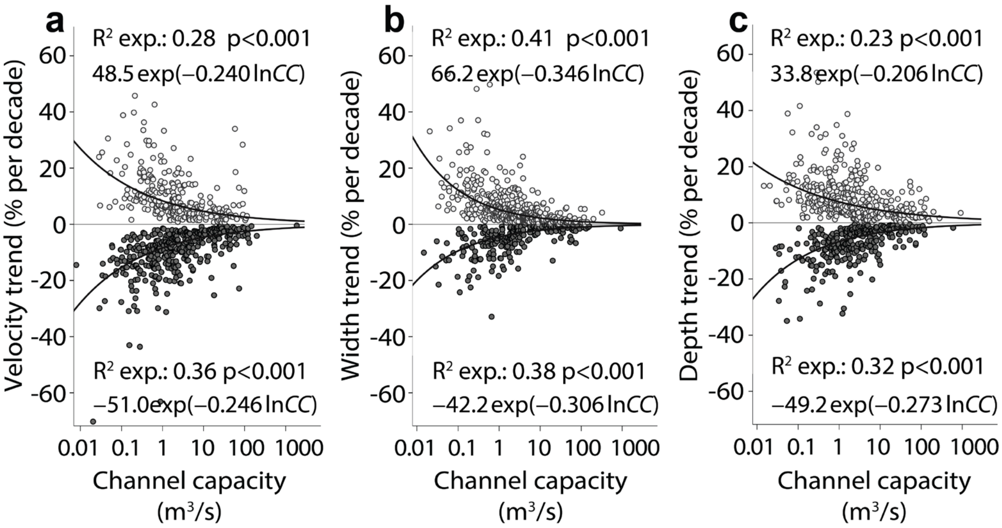


Figure 4.11. Relationship between significant increases/decreases in (a) velocity, (b) width, and (c) depth (all in %/decade), versus channel capacity (m³/s). Exponential fits to the log-transformed channel capacity (lnCC) and associated R^2 are displayed (R^2 values were higher than for linear, logarithmic, and power curves). Spearman's correlation coefficients for the same data were all significant at the p<0.001 level, with ρ values of: +0.6/−0.6 for velocity, +0.6/−0.6 for width, and +0.6/−0.5 for depth.

This negative relationship between trend magnitude and scale is inverse to the one presented in chapter 2 between rates of bed elevation change and drainage area. This is because dimensional trends which are not normalised for scale (i.e. presented in mm rather than in %) tend to increase with channel size.

Percentage trends however, tend to decrease with channel size, suggesting that large channels tend to be proportionally more stable than small river channels.

Second, we found a positive relationship between the magnitude of velocity, width and depth trends and the R-B index (Figure 4.12), suggesting that streams with flashy flow regimes, such as Mill Creek in Figure 4.6a, tend to have much more changeable channel geometry than stable flow regimes.

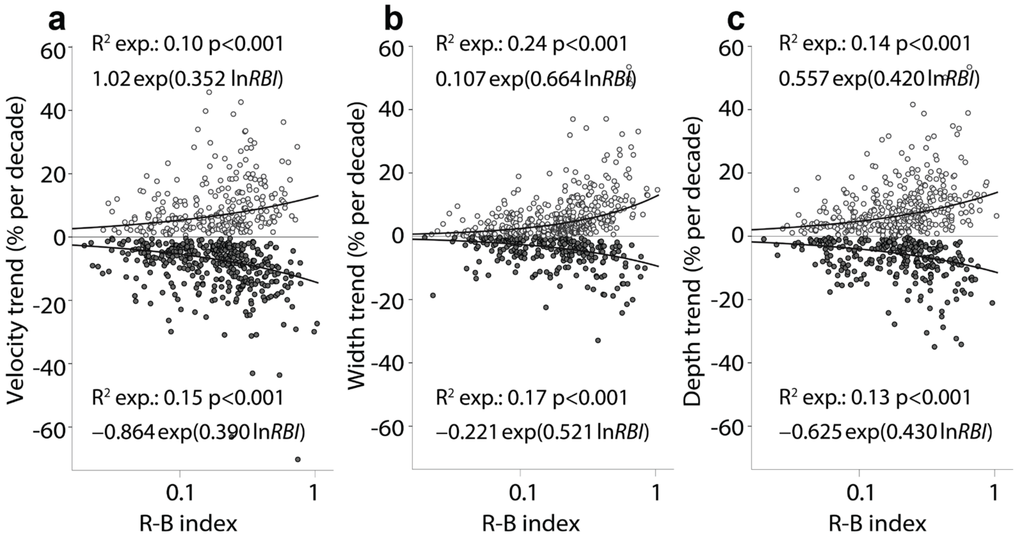


Figure 4.12. Relationship between significant increases/decreases in (a) velocity, (b) width, and (c) depth (all in % per decade), versus R-B index. Exponential R^2 fits to the log-transformed R-B index values (lnRBI) are displayed (R^2 values were higher than for linear, logarithmic, and power curves). Spearman's correlation coefficients were all significant at the p<0.001 level, with ρ values of −0.4/+0.3 for velocity, −0.4/+0.5 for width, and −0.4/+0.4 for depth.

Why would flashy streams exhibit greater rates of change in channel geometry? Flashiness describes the average day-to-day changes in flow magnitude, and can be considered as a proxy of energy expenditure in the channel per unit time (Batalla and Vericat, 2009; Tena et al., 2011). Thus, high flashiness indices suggest higher rates of energy expenditure, which are reflected in the increased erosion rates found here, and in the sediment transport rates documented in other work (Batalla and Vericat, 2009).

Several further potential explanations for higher rates of change in flashy streams have been suggested in the literature, and may warrant further investigation. First, flashy flows tend to heighten riverbank instability, as the sudden saturation of bank material and concomitant increases in pore-water pressure (rapid decreases in matric suction) reduce the cohesiveness of riverbank material. When these effects are combined with an abrupt loss of hydrostatic-confining pressure on the receding limb of flood flows, the probability of bank failure is substantially increased (Simon et al., 2000). Second, the beds of streams with highly variable flow regimes tend to be less well armoured than those of with less variable flow (Laronne et al., 1994), as the hydrograph rising limbs are too short (Figure 4.6a) to extract fine sediments from the bed and recession times insufficient to allow for sediment sorting (Hassan et al., 2006), thus such riverbeds may fluctuate more readily. Finally, streams with flashy or extreme flow regimes also tend to have less well-established vegetation cover than channels with more stable flows (Stromberg et al., 2007), so they lack the stabilizing influence of vegetation, which reduces the flow velocity that is needed to erode and deposit sediment (Hickin, 1984), and absorbs the shear stress of flow in its roots (Simon and Pollen, 2006; Wynn and Mostaghimi, 2006). These interpretations may warrant further investigation into the nature of the relationship between streamflow flashiness and the rates of change in channel geometry.

How is streamflow flashiness affected by changes in scale and climate? Runoff is typically more variable in small basins (Ward and Robinson, 1967; Wolman and Miller, 1960), so flashiness decreases as channel/catchment size increases, as the peak flows within the main channel are attenuated by the complex timing of flow delivered from various tributaries, and as flow is routed through the catchment in increasingly composite ways (Fongers et al., 2012).

Thus, as streamflow flashiness decreases, the average cross-sectional flow velocity, channel width, and average flow depth all appear to increase (Figure 4.13). Interestingly, Yu and Wolman had already noted the inverse relationship between flow variability and channel geometry, showing that streams with greater flow variability also tend to have narrower channels (Yu and Wolman, 1987, p. 504). However they had only noted the relationship between flow variability and channel width, and not the fact that flow variability is expressed in all three components of channel geometry (Figure 4.13). We find that flow velocity, width and depth behave similarly and that their average values are smaller in channels with variable flow.

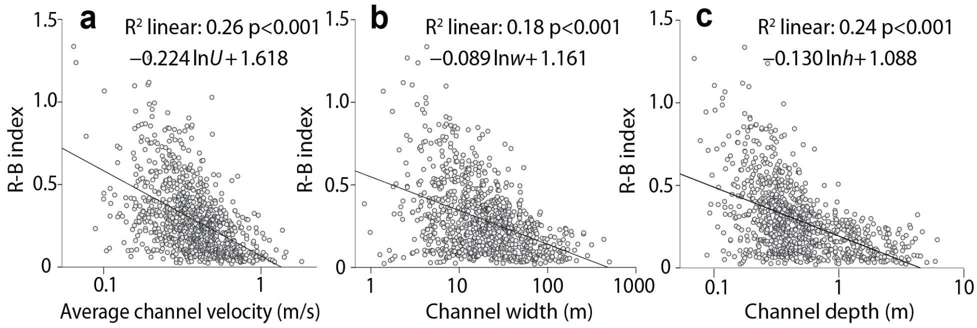


Figure 4.13. Relationship between R-B flashiness index and average cross-sectional channel velocity (m/s), width (m), and average depth (m). Linear curves were fit to log-transformed values of velocity, width, and depth (lnU, lnw and lnh respectively). R^2 values were higher than for logarithmic, power, and exponential curves.

4.3.3. Does velocity, width or depth drive capacity shifts?

Because significant trends in velocity, width, and depth tend to offset one another and have varying influences on changes in channel capacity, it remains to be determined which of these components is most likely to 'drive' the shift in channel capacity, in channels of different sizes and with different levels of flashiness [even though all trends are typically larger in small and flashy channels (as seen above in Figure 4.11 and Figure 4.12)]. Following equation

4.6d, direct comparisons can be made between the magnitude of percentage trends in streamflow velocity, width, and depth.

To compare the relative magnitudes of streamflow velocity, width, and depth trends in terms of their overall effect on the channel capacity, as in equation 4.6 (e.g. whether the % change in width exceeds the % change in depth), we split the 973 sites were split into groups of two (width/depth, width/velocity, and depth/velocity) and a group of three (width/depth/velocity), and assessed which % trend was the largest of the two or three. We then compared the distributions and medians of channel capacity and R-B index across these different groups. The figures below only display the groups that had statistically significant distributions and medians.

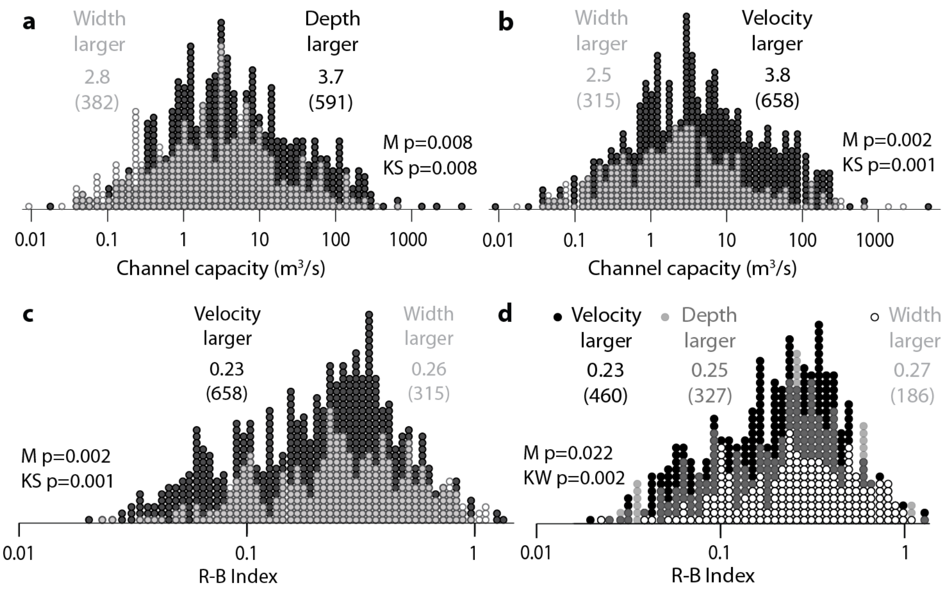


Figure 4.14. Distribution of (a-b) channel capacity (m^3/s), and (c-d) R-B index, split by dominant driver: flow velocity, width or depth. Data were assessed in pairs, and group of 3, as described in text. Significance levels for the independent samples Medians test, the Kolmogorov-Smirnov test, and the Kruskal-Wallis test are indicated by the letters M, KS, and KW, respectively. As in Figure 4.9, distribution medians are indicated beneath offsetting/additive distribution labels, and the number of sites in each group is indicated in parentheses. Sites

where width trends exceed velocity or depth trends are displayed as white circles; sites where velocity or depth trends exceed width trends are displayed as dark circles.

Results show that trend magnitude varies significantly by channel size (Figure 4.14a-b), with larger width trends in channels of small capacity, and larger depth trends in channels of large capacity (Figure 4.14a). This can be explained by the shape of small *versus* large channels. In small channels, the wetted length of the two banks tends to exceed the length of the river bed, while the reverse is true in wide channels. Thus, if width and depth trends are of equal magnitude, shifts in cross-sectional area should be driven by width trends in small channels (where $2 \cdot h > w$) and by depth trends in large channels.

Magnitudes of velocity, width, and depth trends also varied by streamflow flashiness (Figure 4.14c-d), with velocity trends exceeding width trends, and to a lesser degree, depth trends, in stable streams (low R-B index). Width trends, as explained above, may be more likely to develop in flashy streams, due to the weakening effects of flashy flows on stream banks (Simon et al., 2000). In stable streams, protracted flood flows (e.g. Figure 4.6b) allow more time for bed sediment sorting (Hassan et al., 2006) and for trends in boundary roughness to develop. Protracted periods of low flows (i.e. the "stress history") can increase the stability and roughness of the riverbed through vertical settlement and particle repositioning (Ockelford and Haynes, 2012) The significantly larger proportion of significant velocity trends in stable streams (75% of sites with RB index <0.1), compared to more flashy streams (65% of sites with RB index >0.1) tends to strengthen this hypothesis.

4.4. Conclusions

An extensive collection of techniques exist to predict average channel dimensions for use in flood modelling, engineering, and conservation. Most of these methods tend to ignore the propensity of alluvial channels to adjust their form in response to changing volumes of streamflow and sediment supply over time. Therefore, comparatively little is known about the rates with which alluvial channels adjust over time.

This final chapter presents the results of the first systematic investigation of trends in cross-sectional velocity, width, and depth, across a broad range of stream channels of varying capacity and flow regime. We find that: (1) trends in velocity, width, and depth at G_{50} are significant at approximately two-thirds of all sites, consistent with chapter two. (2) The significant majority of channels are widening and degrading, with decreasing velocity. Whether these trends occur in sync (additive: same signs) or not (offsetting: opposite signs) is a sign of whether channel capacity is in equilibrium or significantly changing over time. (3) The magnitudes of these trends are primarily controlled by (a) scale, so rates of velocity, width, and depth (in %/decade) decrease with channel capacity; and (b) flow regime, so rates increase with average streamflow flashiness. (4) Finally, we assess which of velocity, width, or depth has the largest influence on the total rate of change in channel capacity, and find that velocity trends are largest in large channels with stable streamflow regimes, width trends are largest in small channels with flashy streamflow regimes, and that depth trends are proportionally largest in large channels. By quantifying decadal rates of change in alluvial channel capacity and assessing the manner in which velocity, width, and depth trends contribute to shifts in channel capacity in channels of varying size and flow regime, this chapter provides novel insight into the potential effects of channel changes over managerial timescales, with broader implications for channel design, engineering, aquatic habitats, and flood management.

5. Thesis Conclusions

5.1. Background

5.1.1. Using hydrometric data to quantify channel change

This thesis started out as an investigation into the potential uses of stream channel measurements to improve our understanding of how the cross-sectional geometry of alluvial river channels changes over time. Until recently, our ability to examine geomorphic change in large numbers of river channels was hindered by the lack of data spanning vast geographic areas and long time-periods.

In the last few years however, the entire historical database of US Geological Survey (USGS) stream channel measurements has been made publicly accessible online (U.S. Geological Survey, 2014e). This database has been gradually built up by hundreds of workers over the past 115 years as a by-product of stream gaging, to define stage-discharge rating curves and estimate how much flow is being carried in a channel at any given point in time (U.S. Geological Survey, 2014d). As alluvial channels adjust their morphology, past rating curves are rendered inaccurate and must be updated with new measurements (Carter and Davidian, 1968). Instead of simply archiving the 'old' hydrometric measurements as they become obsolete, this thesis shows how we can *use* these data to obtain valuable insight into the geomorphic changes that occur in river channels.

Provided one establishes rigorous filtering procedures, the streamflow measurements can be employed to estimate temporal trends in the average velocity, the width, and the average depth of the cross-sectional flow of river channels across a broad range of climatic and geologic contexts. However, quantifying trends in channel geometry puts into question the basic geomorphic assumption that most alluvial channels are "in regime", i.e. have achieved a mean, equilibrium channel form and do not exhibit a trend in their geometry over decadal timescales.

5.1.2. The assumption of regime channels

Over the course of the past half-century, attempting to define and quantify the average channel form or 'hydraulic geometry' of rivers in different physiographic regions and climates has become one of the dominant research areas in fluvial geomorphology (Leopold and Maddock, 1953; Huang and Nanson 2000; Eaton and Church 2007). Much of the existing work assumes that alluvial stream channels have adjusted to an average cross-sectional size and shape that reflects the mean solid and liquid discharge that is supplied to them from the upstream basin. Alluvial channels may modify their beds and banks to accommodate small temporal changes in flow and sediment, yet they are expected to retain a "mean" channel form over decadal timescales (Schumm and Lichty, 1965).

The assumption that average channel form is stable over time is fundamental to the application of regime theories (Lane, 1955; Griffiths, 1983) which have proven extremely useful in river engineering to estimate the average channel geometry and to design riverside and flood control structures. However, it is important to recognise that we have profoundly modified the average volumes of streamflow and sediment that transit downstream in basins around the world, and that many river channels are still adjusting to these new regimes. It is well known, for example, that the Mississippi valley has transitioned over the past century from a transport-limited (excess sediment) to a supply-limited (sediment-starved) system, due to the proliferation of dams and engineering structures that cut off the sediment supply to the streams (Meade and Moody, 2010).

These anthropogenic modifications to river basins affect the velocity, width, and depth of channel cross-sectional flow, as rivers adjust their geometries to accommodate the new flow regimes and sediment loads. Channel adjustment processes often exhibit lag effects (Simon, 1994) and so fluvial networks may take many decades to adapt to modifications that occurred upstream. For example, substantial sediment yields generated by landuse changes can be stored throughout river basins in the form of sediment slugs (Nicholas et al., 1995) and may only be flushed or propagated downstream episodically, during high flow events.

In a nonstationary world with a changing climate (Milly et al., 2008), it is becoming increasingly apparent that the assumption of regime channels is inappropriate for channel design. The adjustments and trends in channel geometry that develop over decadal timescales present a real, measurable threat to the stability of riverside infrastructure, navigation and flood hazard. Instead of defining an expected equilibrium form of alluvial channels, it may be more judicious to establish an "envelope of uncertainty" of geomorphic change, based on the potential trends and variability in channel geometry that we expect to see in any given stream channel.

It is essential that we start monitoring these changes in channel form to improve our understanding of the *dynamic* nature of contemporary fluvial systems. This thesis provides a first attempt to quantify shifts in alluvial channel cross-sectional form using historical stream gaging measurements.

5.2. Results

5.2.1. Magnitudes of trends in channel geometry

One of the primary aims of this work was to develop new methods to investigate the trends and variability in channel cross-sectional geometry at gaging stations across the USA, and to determine whether these trends have been statistically significant over the course of the past sixty years. In chapters 2 to 4, we estimated the rates of change in the discharge, average velocity, width, and average depth (~bed elevation) of the cross-sectional flow.

Results show that significant channel adjustment is expressed at approximately two-thirds of all studied sites, when measured at sub-bankfull levels (the "median stage"). These proportions suggest that the majority of U.S. stream channels are in a nonstationary state over decadal timeframes, thus thwarting attempts at defining a "regime channel" for most stream cross-sections over such short time periods.

The average estimated magnitudes of *significant* decadal trends in channel form at the median stage were of −8/+7 % for velocity, −4/+4 % for width, and −6/+7 % for depth (see Figure 4.7). In dimensional units, median trends were of −0.03/+0.03 m/s per decade for velocity, −0.8/+0.7 m per decade for width, and −30/+30 mm per decade for depth (chapter 4). Thus, on average, very small dimensional shifts in velocity actually contributed more than width and depth trends to the overall changes in channel capacity. Our findings suggest – at a continental scale – that the cross-sectional capacity of river channels is governed just as much by changes in channel roughness as by changes in the sediment mass balance.

5.2.2. Controls on trends in channel geometry

What controls these shifts in alluvial channel form over time? Throughout this work, numerous controls were investigated, including lithology, drainage density, mean climate, and basin slope. Surprisingly, only two main controls were clearly apparent in all locations.

The primary control on rates of change is the scale at which measurements are made. As the contributing drainage area and the capacity of the river channel increase (chapters 2 and 4), the dimensional rates of change, measured in mm, also tend to increase (chapter 2). However, proportional rates of change (in %), are negatively correlated with the channel size or basin area (chapter 4), suggesting that absolute and proportional changes in channel size or capacity should be considered separately.

A secondary major control on trend magnitude is the variability (Q_{90}/Q_{50}) or flashiness (R-B index) of streamflow. Rates of change in alluvial channel geometry were found to increase with Q_{90}/Q_{50}, i.e. the annual variability in the magnitude of high flows (chapter 2) and with the R-B flashiness index, which describes the average daily fluctuations in streamflow at any given site (chapter 4).

5.2.3. Effects of changes in channel geometry on flood hazard

The widespread nature of these changes in channel capacity suggests that geomorphological trends may well alter the frequency and magnitude of flood hazard in many locations independently from hydrological trends. This finding prompted me to investigate the influence of channel capacity on flood hazard. The third chapter thus introduces a new statistical procedure for disentangling the hydrologic and geomorphic drivers of trends in flood hazards. The "flow frequency effect" is quantified as the changes in flood hazard frequency that would arise in the absence of trends in channel capacity, and the "channel capacity effect" as the trend in flood hazard frequency that would arise from the observed shifts in channel capacity at flood stage, if the flow frequency distribution were held constant. This new method allows us to separate the two effects and to quantify the influence of each one on flood hazard independently.

Overall, we found that more than half of the 401 sites showed significant trends in channel capacity and/or flow frequency (in units of flood hazard frequency), suggesting that flood hazard is chiefly nonstationary across the studied locations. Flow frequency trends were consistent with previously documented trends in heavy and extreme precipitation events. Increases in streamflow frequency were almost twice as frequent as the decreases, suggesting that flood hazard is increasing significantly across the United States.

Trends in channel capacity, surprisingly, contributed to changes in flood hazard on a scale that was of the same order of magnitude as flow frequency trends (medians: +10/−10 % per decade, *versus* +30%/−64 % per decade, respectively). Perhaps even more importantly, these significant trends in channel capacity were nearly three times more frequent than significant flow frequency trends. Thus although changes in channel morphology may have a slightly weaker influence on flood hazard than changes in hydrological regimes, they appear to be far more common and widespread, and/or easier to detect.

Lastly, this chapter found that channel capacity and flow frequency trends were largely independent (uncorrelated), except in sites that had experienced substantial anthropogenic flow modification. The absence of correlation implies that *both* geomorphic and hydrologic trends must be quantified if one wishes to determine how flood hazard is changing over time, and whether changes in the channel capacity may intensify flow frequency trends, or on the contrary, lessen them.

5.2.4. Interaction between velocity, width and depth

If changes in channel capacity are so widespread and have a significant influence on the flood hazard frequency, one may wonder precisely *how* these geomorphic changes are expressed, and whether shifts in flood hazard are due primarily to shifts in the channel width, the average depth or the average velocity of the cross-sectional streamflow.

Chapter four thus investigated the relationship between velocity, width, and depth trends in different channel cross-sections. Surprisingly, the significant majority of US channels were widening and degrading with decreasing velocity, suggesting that flow equilibrium is maintained by a balance between cross-sectional flow area and velocity. Overall, the majority of these velocity, width and depth trends showed opposite signs, satisfying the concept of dynamic equilibrium.

These relationships between velocity, width and depth varied depending on the type of river, so that in small/flashy streams, channel geometry trends (velocity, width and depth) tended to develop concomitantly (in the same direction), while in large rivers with stable flow regimes, they tended to develop independently (opposite directions). Further, results showed that velocity trends tended to contribute more than width/depth trends to shifts in channel capacity in large channels with stable flow regimes; width trends tended to be the largest in small channels with flashy flow regimes; and depth trends tended to be the largest in large channels. These findings necessitate further investigation in different contexts, to better understand the causes of changes in channel geometry.

5.3. Perspectives and future research avenues

A number of research avenues merit further investigation and will become increasingly practicable now that geo-referenced gaging data are beginning to be published as Open Data around the world.

5.3.1. Using ADCP measurements to analyse changes in channel morphology worldwide

One of the principal challenges of this analysis is to pinpoint the exact location where streamflow gagings are made, so that trends in channel geometry can be measured in one consistent cross-sectional location over time. While most gagings tend to be made in a similar spot near the gage, the exact location chosen by the operator may vary depending on the instrument used (e.g. an ADCP or a current meter, the choice of which may vary over time), the type of ADCP (some need deeper water, some slower water), the presence of obstructions in the river (such as weed growth or debris), the operator (and their knowledge of the instruments or of the site), and the time of year or meteorological conditions (since low and high flows are not always made in the same location). To increase confidence in transect location, we excluded measurements made at low and high flows (Figures 3.4 and 4.3), and we plotted all measurements to verify channel shape (e.g. Figure 3.5). However, due to the inherent uncertainties in measurement location, we were only able to conduct the analysis for a limited number of carefully-selected historical stream gage records.

To expand these analyses to a wider number of locations, it is vital that the precise geo-reference and meta-description of each gaging transect are provided to the public along with the data. Currently, in both the UK and the USA, the publicly-accessible archives do not contain a precise indication of the location where each measurement was made, since the principal aim of stream gaging is to provide the most accurate measurement of the flow in the conditions present on the day, rather than to record the shape of the channel at a given point in space and time. The lack of adequate georeferencing is also due to the structure of hydrometric data archives, many of which do not contain a parameter for recording GPS coordinates. In the UK, the gaging measurement location is subjectively provided in a column titled "Comments" or "Remarks" as, for example, "measurement made 20 m upstream from bridge". Automating the data analyses would be far easier if the precise GPS coordinates of these measurements were provided to the users as a numeric value in a sortable column.

Another hindrance to geo-referencing is the lack of adequate instrumentation. For the moment, only a minority of boat-mounted ADCPs around the world are able to geo-locate streamflow measurements with a GPS. Ideally, as the measurement techniques develop, we would hope for consistency in international streamgaging standards. If the processed ADCP gaging files were archived in the same format and published as Open Data online, then one could conceivably – in the future – automate data downloads from different regions around the world, geo-locate all of the measurements, and quantify changes in stream channels across a wide range of locations.

The procedures described herein serve as a first step for understanding the challenges associated with filtering these data before conducting time-series analyses. One could then determine which rivers of the world are progressively narrowing/widening, aggrading/degrading, how velocity patterns are changing, and how these geomorphic changes are contributing to shifts in flood hazard.

5.3.2. Further separating the different drivers of flood hazards

We showed that trends in flood hazard frequency are driven by two principal components: the frequency of flood flows from the upstream basin ("flow frequency"), and the capacity of the river channel to contain those flows ("channel capacity"). If either of these components changes, the resulting flood hazard frequency will be modified. In future work, it would be useful to illustrate, from a statistical perspective, how the total change in flood hazard frequency at any given location (e.g. the trend in the number of days above a fixed value of stage) can be calculated as the sum of the channel capacity and flow frequency effects, as defined in chapter 3 (Slater et al., 2015).

One may further disentangle the drivers of flood hazard by attributing the changes in flood frequency to specific causes. The influence of hydrologic trends on flood hazard frequency can be broken down into (i) the changes in streamflow that originate from atmospheric changes such as precipitation trends ("atmospheric effects") and (ii) those that originate from changes at the Earth's surface, such as land use ends ("Earth-surface effects"). The influence of geomorphic change on flood hazard can also be subdivided into (i) the changes in capacity that arise from shifts in the average cross-sectional flow velocity ("flow velocity effects") and (ii) the changes in capacity that arise from shifts in the cross-sectional flow area ("flow area effects") (Figure 5.1).

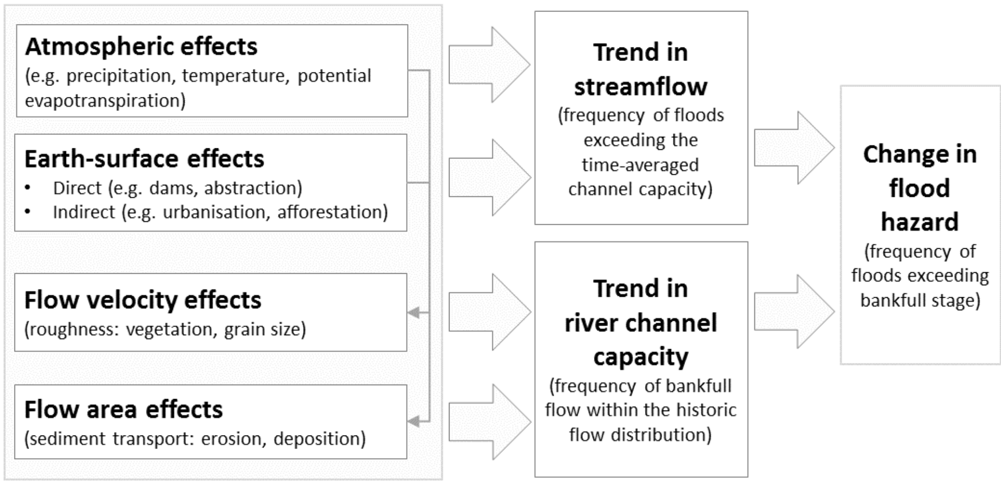


Figure 5.1. Simplified schematic of flood hazard drivers to be integrated in a predictive framework

5.3.3. Upscaling these analyses from the cross-section to the reach

Hydrometric archives of cross-sectional channel measurements are a valuable resource for understanding how our rivers have changed since the end of the nineteenth century. However, these archives only document changes in channel geometry at the scale of the cross-section. To better understand how our channels are changing, we would need to upscale these analyses from the cross-section to the river reach.

Recent technologies such as terrestrial laser scanners and acoustic Doppler current profilers (ADCPs) allow us to map entire reaches of stream channels and to model the distribution of flow velocities and bathymetry with very little error. These new methods are much faster, and sometimes much safer, than the methods that existed in the past, allowing us to repeat measurements with more ease and speed than ever before. It is therefore extremely likely that in the future we will start to use repeat ADCP surveys of river reaches at different points in time to understand exactly how river morphology and hydrology are changing in some of the most critical locations.

5.4. Final words

This thesis illustrates how hydrometric data may be used to understand changes in river channel geometry and flood hazard over time. The cross-sectional measurements of stream channels that have been archived as a by-product of stream gaging since the end of the nineteenth century are one of our most valuable resources for understanding how river channels have evolved in the last hundred years. However, many stream gage records are currently at risk of being discontinued. If we truly wish to understand how our rivers are evolving with climate change and demographic growth, it is essential that we acknowledge the importance of investing in continued hydrometric data collection. Only then will we have records that are long enough to foresee changes in channel morphology, river navigability, aquatic health and flood hazards in years to come.

6. Notation and Acronyms

Notation

a_i	residual
$\hat{\alpha}_{\varepsilon i}$	estimated value of cross-sectional discharge, average flow velocity, average flow depth, or channel width at G_{50} (can be $\hat{Q}$, $\hat{U}$, $\hat{w}$ or $\hat{h}$)
A	channel cross-sectional flow area
$\hat{A}$	estimate of A at flood stage (chapter 3) or at G_{50} (chapter 4)
A_{FS}	channel cross-sectional flow area at flood stage
$\overline{A_{FS}}$	fixed average value of A at flood stage over a given period
$\overline{A_{50}}$	fixed average value of A at G_{50} over a given period
CC	channel capacity at flood stage
D	sediment size
D_{50}	median grain size of the bed material
Δt	date–mean(date)
F_B	bed factor
F_i	exceedance frequency of each daily streamflow value
F_S	side factor
FF	flow frequency at flood stage
G	gage height or stage, measured above a fixed channel datum
G_{50}	median (50th percentile) of stage in the range of stage measurements
g	gravitational acceleration
h	average cross-sectional flow depth
$\hat{h}$	estimate of h at G_{50} (chapter 4)
$\overline{h_{50}}$	fixed average value of h at G_{50} over a given period
$\ln\left(h_i\right)$	natural logarithm of the observed value of h
$\ln\left(\hat{h}_{\varepsilon i}\right)$	residual to the Loess curve relating ln(h) to ln(G)
$\ln\left(\overline{h}_i\right)$	estimated value from the Loess curve relating ln(h) to ln(G)
$\ln\left(A_i\right)$	natural logarithm of the observed value of A
$\ln\left(\hat{A}_{\varepsilon i}\right)$	residual to the Loess curve relating ln(A) to ln(G)
$\ln\left(\overline{A}_i\right)$	estimated value from the Loess curve relating ln(A) to ln(G)

$\ln(Q_i)$ natural logarithm of the observed value of Q

$\ln(\hat{Q}_{\varepsilon_i})$ residual to the Loess curve relating ln(Q) to ln(G)

$\ln(\bar{Q}_i)$ estimated value from the Loess curve relating ln(Q) to ln(G)

$\ln(U_i)$ natural logarithm of the observed value of U

$\ln(\hat{U}_{\varepsilon_i})$ residual to the Loess curve relating ln(U) to ln(G)

$\ln(\bar{U}_i)$ estimated value from the Loess curve relating ln(U) to ln(G)

$\ln(w_i)$ natural logarithm of the observed value of w

$\ln(\hat{w}_{\varepsilon_i})$ residual to the Loess curve relating ln(w) to ln(G)

$\ln(\bar{w}_i)$ estimated value from the Loess curve relating ln(w) to ln(G)

MAR median absolute residual

n total number of mean daily streamflow values

p bed sediment porosity

q_i mean daily streamflow value

Q cross-sectional Q water discharge

Q_b bedload sediment flux

$\hat{Q}$ estimate of Q at flood stage (chapter 3) or at G_{50} (chapter 4)

Q_{FS} cross-sectional Q at flood stage

$\overline{Q_{FS}}$ fixed average value of Q at flood stage over a given period

$\overline{Q_{50}}$ fixed average value of Q at G_{50} over a given period

Q_{50} fiftieth percentile of the annual streamflow distribution

Q_{90} ninetieth percentile of the annual streamflow distribution

r fractional change in values per unit of time

R_h hydraulic radius

Re_p particle Reynolds number

ρ density of water

ρ_s sediment mass density

r fractional change in values per unit of time

S channel gradient (slope)

t time

τ shear stress

$\tau*$ dimensionless shear stress

τ_b*	dimensionless critical shear stress
τ'	effective shear stress
x	longitudinal downstream coordinate
u	mean flow velocity of a channel segment
U	average cross-sectional flow velocity
U_{FS}	average cross-sectional flow velocity at flood stage
$\overline{U_{FS}}$	fixed average value of U at flood stage over a given period
$\overline{U_{50}}$	fixed average value of U at G_{50} over a given period
$\hat{U}$	estimated value of U (chapter 3) or at G_{50} (chapter 4)
w	width of the flow surface
$\hat{w}$	estimate of w at G_{50} (chapter 4)
$\overline{w_{50}}$	fixed average value of w at G_{50} over a given period
w_i	weight (for Cauchy weighting function)
WP	wetted perimeter (length of the wetted channel boundaries)
z	riverbed elevation above a fixed datum

Acronyms

ADCP	Acoustic Doppler current profiler
ADR	Annual water Data Report
ALS	Airborne Laser Scanning
DTM	Digital Terrain Model
EDM	Electronic Distance Measuring
FEMA	United States Federal Emergency Management Agency
FHF	Flood hazard frequency
GAGES II	Geospatial Attributes of Gages for Evaluating Streamflow
IRLS	Iteratively Reweighted Least Squares
LIDAR	LIght Detection And Ranging
NFIP	National Flood Insurance Program
NSIP	National Streamflow Information Program
NWIS	National Water Information System Web Interface
PRISM	Parameter Elevation Regressions on Independent Slopes Model
Sfm	Structure-from-motion
TLS	Terrestrial Laser Scanning
USGS	United States Geological Survey

7. List of references

Allred, T.M., Schmidt, J.C., 1999. Channel narrowing by vertical accretion along the Green River. Geological Society Of America Bulletin 111, 1757–1772.

Andrews, E.D., 1984. Bed-material entrainment and hydraulic geometry of gravel-bed rivers in Colorado. Geological Society of America Bulletin 95, 371–378.

Andrews, E.D., 1986. Downstream effects of Flaming Gorge Reservoir on the Green River, Colorado and Utah. Geological Society of America Bulletin 97, 1012–1023.

ASCE, 1998. Task Committee on Hydraulics, Bank Mechanics, and Modeling of River Width Adjustment, River width adjustment. I: Processes and mechanisms. Journal of hydraulic engineering 124, 881–902.

ASCE Task Committee on Sediment Transport and Aquatic Habitats, 1992. Sediment and aquatic habitat in river systems. Journal of Hydrologic Engineering 118, 669–687.

Bagnold, R., 1966. An approach to the sediment transport problem from general physics. US Geological Survey Professional Paper.

Baker, D., Richards, R., Loftus, T., Kramer, J., 2004. A new flashiness index: characteristics and applications to midwestern rivers and streams. Journal of the American Water Resources Association 503–522.

Baker, V.R., 1977. Stream-channel response to floods, with examples from central Texas. Geological Society of America Bulletin 88, 1057–1071.

Bales, J.D., Wagner, C.R., 2009. Sources of uncertainty in flood inundation maps. Journal of Flood Risk Management 2, 139–147.

Batalla, R., Vericat, D., 2009. Hydrological and sediment transport dynamics of flushing flows: implications for management in large Mediterranean rivers. River Research and Applications 25, 297–314.

Bates, P., Horritt, M., Hunter, N., Mason, D., Cobby, D., 2005. Numerical modelling of floodplain flow, in: Computational Fluid Dynamics: Applications in Environmental Hydraulics. Wiley, Chichester, pp. 271–304.

Bathurst, J.C., 1993. Flow resistance through the channel network, in: Beven, K., Kirkby, M.J. (Eds.), Channel Network Hydrology. Wiley, Chichester, pp. 69–98.

Beschta, R.L., Pyles, M.R., Skaugset, A.E., Surfeet, C.G., 2000. Peakflow responses to forest practices in the western cascades of Oregon, USA. Journal of Hydrology 102–120.

Biedenharn, D., Watson, C., 1997. Stage adjustment in the lower Mississippi River, USA. Regulated Rivers: Research & Management 13, 517–536.

Biggert-Waters Flood Insurance Reform Act of 2012 (2012), 112th U.S. Congress. P.L. 112-141, H.R. 4348–512.

Bjerklie, D.M., Moller, D., Smith, L.C., Dingman, S.L., 2005. Estimating discharge in rivers using remotely sensed hydraulic information. Journal of Hydrology 309, 191–209.

Blench, T., 1952. Regime theory for self-formed sediment-bearing channels. Transactions of the American Society of Civil Engineers 117, 383–400.

Blench, T., 1969. Mobile-bed fluviology; a regime theory treatment of canals and rivers for engineers and hydrologists. University of Alberta Press, Edmonton.

Blöschl, G., Ardoin-Bardin, S., Bonell, M., Dorninger, M., 2007. At what scales do climate variability and land cover change impact on flooding and low flows? Hydrological Processes 1241–1247.

Brasington, J., Rumsby, B.T., McVey, R.A., 2000. Monitoring and modelling morphological change in a braided gravel-bed river using high resolution GPS-based survey. Earth Surface Processes and Landforms 25, 973–990.

Bray, D.I., 1975. Representative discharges for gravel-bed rivers in Alberta, Canada. Journal of Hydrology 27.

Bray, D.I., 1982. Regime equations for gravel-bed rivers, in: Hey, R.D., Bathurst, J.C., Thorne, C.R. (Eds.), Gravel Bed Rivers. Wiley, Chichester, pp. 517–542.

Brice, J.C., 1984. Planform properties of meandering rivers, in: Elliott, C.M. (Ed.), River Meandering. American Society of Civil Engineers, New Orleans, pp. 1–15.

Brune, G., 1953. Trap efficiency of reservoirs. Transactions, American Geophysical Union 34, 407–418.

Brunner, G., 2010. HEC-RAS river analysis system, Hydraulic reference manual, Version 4.1. US Army Corps of Engineers Hydrologic Engineering Center, Davis CA 1–790.

Buffington, J.M., Montgomery, D.R., 1997. A systematic analysis of eight decades of incipient motion studies, with special reference to gravel-bedded rivers. Water Resources Research 33, 1993–2029.

Buffington, J.M., Roper, B.B., Archer, E., Moyer, C., 2009. Reply to discussion by David L. Rosgen: The role of observer variation in determining Rosgen stream types in northeastern Oregon mountain streams. Journal of the American Water Resources Association 45, 1298–1312.

Carter, R.W., Davidian, J., 1968. Chapter A6 - General procedure for gaging streams, Book 3 - Applications of hydraulics, in: Techniques of Water Resources Investigations of the USGS. pp. 1–13.

Chang, H.H., 1979. Minimum stream power and river channel patterns. Journal of Hydrology 41, 303–327.

Charlton, F.G., Brown, P.M., Benson, R.W., 1978. The hydraulic geometry of some gravel rivers in Britain, Hydraulics Research Station.

Clarke, S.J., 2002. Vegetation growth in rivers: influences upon sediment and nutrient dynamics. Progress in Physical Geography 26, 159–172.

Cleveland, W., 1979. Robust locally weighted regression and smoothing scatterplots. Journal of the American Statistical Association 74, 829–836.

Clubb, F.J., Mudd, S.M., Milodowski, D.T., Hurst, M.D., Slater, L.J., 2014. Objective extraction of channel heads from high-resolution topographic data. Water Resources Research 50, 1944–7973.

Collins, D.B.G., Bras, R.L., 2008. Climatic control of sediment yield in dry lands following climate and land cover change. Water Resources Research 44, 1–8.

Collins, D.B.G., Bras, R.L., 2010. Climatic and ecological controls of equilibrium drainage density, relief, and channel concavity in dry lands. Water Resources Research 46, 1–18.

Copeland, R.R., 1994. Application of channel stability methods — case studies. Technical Rep. No. HL-94-11, U.S. Army Engineer Water-ways Experiment Station, Vicksburg, Miss. 1–60.

Costa, J., O'Connor, J., 1995. Geomorphically effective floods. Natural and anthropogenic influences in fluvial geomorphology 45–56.

Cotton, J. a., Wharton, G., Bass, J. a. B., Heppell, C.M., Wotton, R.S., 2006. The effects of seasonal changes to in-stream vegetation cover on patterns of flow and accumulation of sediment. Geomorphology 77, 320–334.

Daniels, J.M., 2008. Distinguishing allogenic from autogenic causes of bed elevation change in late Quaternary alluvial stratigraphic records. Geomorphology 101, 159–171.

DeGaetano, A.T., 2009. Time-Dependent Changes in Extreme-Precipitation Return-Period Amounts in the Continental United States. Journal of Applied Meteorology and Climatology 48, 2086–2099.

Doppler, J.C., 1842. Über das farbige Licht der Doppelsterne und einiger anderer Gestirne des Himmels: Abn.königl. böhm.Ges.Wiss, v. 2, p. 465–482.

Douglas, E.M., Vogel, R.M., Kroll, C.N., 2000. Trends in floods and low flows in the United States: impact of spatial correlation. Journal of Hydrology 240, 90–105.

Dunne, T., 1979. Sediment yield and land use in tropical catchments. 1979 42, 281–300.

Eaton, B.C., Church, M., 2007. Predicting downstream hydraulic geometry: a test of rational regime theory. Journal of Geophysical Research 112, 1–18.

Eaton, B.C., Church, M., 2011. A rational sediment transport scaling relation based on dimensionless stream power. Earth Surface Processes and Landforms 901–910.

Emmett, W.W., Wolman, M.G., 2001. Effective discharge and gravel-bed rivers. Earth Surface Processes and Landforms 26, 1369–1380.

Exner, F., 1920. Zur Physik der Dünen. Sitzungsberichte der Akademie der Wissenschaften in Wien. Mathematisch-naturwissenschaftliche Klasse. 129(2a), 929–952.

Exner, F., 1925. Uber die wechselwirkung zwischen wasser und geschiebe in flüssen. Sitzungsberichte der Akademie der Wissenschaften in Wien. Abteilung IIa 165–207.

Falcone, J.A., 2011. GAGES II (Geospatial Attributes of Gages for Evaluating Streamflow) summary report. USGS 1–24.

Famiglietti, J.S., Rodell, M., 2013. Water in the balance. Science 340, 1300–1301.

Farquharson, F.A.K., Meigh, J.R., Sutcliffe, J.V., 1992. Regional flood frequency analysis in arid and semi-arid areas. Journal of Hydrology 138, 487–501.

Ferguson, R.I., 1986. Hydraulics and hydraulic geometry. Progress in Physical Geography 10, 1–31.

Field, C.B., Barros, V., Stocker, T.F., Dahe, Q., (Ed.), 2012. Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation: Special Report of the Intergovernmental Panel on Climate Change (SREX). Cambridge University Press, Cambridge.

Fongers, D., Day, R., Rathbun, J., 2012. Application of the Richards-Baker Flashiness Index to gaged Michigan rivers and streams. DEQ Michigan's Nonpoint Source Program 1–149.

Friedman, J., Auble, G., 2000. Floods, flood control, and bottomland vegetation, in: Inland Food Hazards: Human, Riparian and Aquatic Communities. pp. 219–237.

Fuller, I.C., Large, A.R.G., Charlton, M.E., Heritage, G.L., Milan, D.J., 2003. Reach-scale sediment transfers: an evaluation of two morphological budgeting approaches. Earth Surface Processes and Landforms 28, 889–903.

Gaffigan, M., 2014. Extreme weather events. Limiting federal fiscal exposure and increasing the nation's resilience. United States Government Accountability Office Testimony.

Gilbert, G.K., 1914. The transport of debris by running water. U.S. Geological Survey Professional Paper 86 1–263.

Gilbert, G.K., 1917. Hydraulic-mining debris in the Sierra Nevada. No 105. US Government Printing Office, Menlo Park, CA.

Graf, W.L., 2006. Downstream hydrologic and geomorphic effects of large dams on American rivers. Geomorphology 79, 336–360.

Gregory, K., 2006. The human role in changing river channels. Geomorphology 79, 172–191.

Gregory, K.J., Park, C., 1974. Adjustment of river channel capacity downstream from a reservoir. Water Resources Research 10, 870–873.

Griffiths, G.A., 1983. Stable-channel design in alluvial rivers. Journal of Hydrology 65, 259–270.

Groisman, P.Y., Knight, R.W., Karl, T.R., 2001. Heavy Precipitation and High Streamflow in the Contiguous United States: Trends in the Twentieth Century. Bulletin of the American Meteorological Society 82, 219–246.

Gunn, M.A., Matherne, A.M., Mason, R.R., 2014. The USGS at Embudo, New Mexico: 125 years of systematic streamgaging in the United States. USGS Fact Sheet 2014–3034.

Hammer, 1972. Stream channel enlargement due to urbanization. Water Resources Research 8, 1530–1540.

Hartshorn, K., Hovius, N., Dade, W.B., Slingerland, R.L., 2002. Climate-driven bedrock incision in an active mountain belt. Science 297, 2036–2038.

Hassan, M.A., Egozi, R., Parker, G., 2006. Experiments on the effect of hydrograph characteristics on vertical grain sorting in gravel bed rivers. Water Resources Research 42, 1–15.

Helsel, D.R., Hirsch, R.M., 1993. Chapter A3 - Statistical Methods in Water Resources, Book 4 - Hydrologic Analysis and Interpretation, in: Techniques of Water Resources Investigations of the United States Geological Survey. Elsevier, Amsterdam, pp. 1–510.

Henshaw, A.J., Gurnell, A.M., Bertoldi, W., Drake, N. a., 2013. An assessment of the degree to which Landsat TM data can support the assessment of fluvial dynamics, as revealed by changes in vegetation extent and channel position, along a large river. Geomorphology 202, 74–85.

Hester, G., Carsell, K., Ford, D., 2006. Benefits of USGS streamgaging program: Users and uses of USGS Streamflow data. National Hydrologic Warning Council 1–18.

Hey, R.D., Thorne, C.R., 1986. Stable channels with mobile gravel beds. Journal of Hydraulic Engineering 112, 671–689.

Hickin, E.J., 1984. Vegetation and River Channel Dynamics. The Canadian Geographer/Le Géographe canadien 28, 111–126.

Hirsch, R., Ryberg, K., 2012. Has the magnitude of floods across the USA changed with global CO2 levels? Hydrological Sciences Journal 57, 1–9.

Holland, P., Welsch, R., 1977. Robust regression using iteratively reweighted least-squares. Communications in Statistics -Theory and Methods 6:9, 813–827.

Hooke, J.M., 1980. Magnitude and distribution of rates of river bank erosion. Earth Surface Processes and Landforms 5, 143–157.

Horritt, M.S., Bates, P.D., 2002. Evaluation of 1D and 2D numerical models for predicting river flood inundation. Journal of Hydrology 268, 87–99.

Huang, H.Q., Nanson, G., 2000. Hydraulic geometry and maximum flow efficiency as products of the principle of least action. Earth Surface Processes and Landforms 16, 1–16.

Inman, D.L., Jenkins, S.A., 1999. Climate change and the episodicity of sediment flux of small California rivers. Journal of Geology 107, 251–270.

Isaacson, K., Coonrod, J., 2011. USGS Streamflow Data and Modeling Sand-Bed Rivers. Journal of Hydraulic Engineering 847–851.

James, A., 1999. Time and the persistence of alluvium: river engineering, fluvial geomorphology, and mining sediment in California. Geomorphology 31, 265–290.

James, L.A., 1991. Incision and morphologic evolution of an alluvial channel recovering from hydraulic mining sediment. Geological Society of America Bulletin 103, 723–736.

James, L.A., 1997. Channel incision on the Lower American River, California, from streamflow gage records. Water Resources Research 33, 485–490.

Janssen, E., Wuebbles, D., Kunkel, K., 2014. Observational and Model based Trends and Projections of Extreme Precipitation over the Contiguous United States. Earth's Future 1–15.

Jemberie, A.A., Pinter, N., Remo, J.W.F., 2008. Hydrologic history of the Mississippi and Lower Missouri Rivers based upon a refined specific-gauge approach. Hydrological Processes 22, 4436–4447.

Jerolmack, D.J., Paola, C., 2010. Shredding of environmental signals by sediment transport. Geophysical Research Letters 37, 1–5.

Johnson, M.G., Beschta, R.L., 1980. Erodibility in Western Oregon. Journal of Forestry 78, 334–337.

Juracek, K.E., Fitzpatrick, F.A., 2009. Geomorphic applications of stream-gage information. River Research and Applications 25, 329–347.

Karl, T.R., Knight, R.W., Plummer, N., 1995. Trends in high-frequency climate variability in the twentieth century. Nature 217–220.

Kennedy, E.J., 1990. Chapter A19, Levels at streamflow gaging stations. Techniques of Water-Resources Investigations of the United States Geological Survey, Book 3, Application of hydraulics 1–39.

Kennedy, R.G., 1895. The prevention of silting in irrigation canals. Proceedings of the Institution of Civil Engineers 119, 281–290.

Kenney, T.A., 2010. Chapter 19 - Levels at Gaging Stations, in: U.S. Geological Survey (Ed.), Section A, Surface-Water Techniques, Book 3, Applications of Hydraulics, Techniques and Methods (3-A19). Reston, Virginia, pp. 1–72.

King, R., 2013. The National Flood Insurance Program: Status and Remaining Issues for Congress. Congressional Research Service 1–39.

Kirchner, J.W., Finkel, R.C., Riebe, C.S., Granger, D.E., Clayton, J.L., King, J.G., Megahan, W.F., 2001. Mountain erosion over 10 yr, 10 k.y., and 10 m.y. time scales. Geology 29, 591–594.

Knighton, A.D., 1973. Riverbank erosion in relation to streamflow conditions, River Bollin-Dean, Cheshire. East Midland Geographer 6, 416–426.

Knighton, A.D., 1974. Variation in width-discharge relation and some implications for hydraulic geometry. Geological Society of America Bulletin 85, 1069–1076.

Knighton, A.D., 2014. Fluvial forms and processes: a new perspective. Routledge.

Knowles, N., Dettinger, M.D., Cayan, D.R., 2006. Trends in Snowfall versus Rainfall in the Western United States. Journal of Climate 19, 4545–4559.

Knox, J.C., 2000. Sensitivity of modern and Holocene floods to climate change. Quaternary Science Reviews 19, 439–457.

Kober, F., Ivyochs, S., Schlunegger, F., Baur, H., Kubik, P., Wieler, R., 2007. Denudation rates and a topography-driven rainfall threshold in northern Chile: Multiple cosmogenic nuclide data and sediment yield budgets. Geomorphology 83, 97–120.

Kochel, R.C., 1988. Geomorphic impact of large floods: review and new perspectives on magnitude and frequency, in: Baker, V.R., Kochel, R.C., Patton, P.C. (Eds.), Flood Geomorphology. J. Wiley & Sons, New York, pp. 169–187.

Koechlin, R., 1924. Mécanisme de l'eau, Libraire Polytechnique. Béranger, Paris.

Kolberg, F.J., Howard, A.D., 1995. Active channel geometry and discharge relations of US Piedmont and Midwestern streams: the variable exponent model revisited. Water Resources Research 31, 2353–2365.

Kondolf, G.M., 1997. Hungry Water: Effects of Dams and Gravel Mining on River Channels. Environmental management 21, 533–51.

Kundzewicz, Z.W. (Ed), 2012. Changes in flood risk in Europe. IAHS Press, Wallingford.

Kundzewicz, Z.W., Kanae, S., Seneviratne, S.I., Handmer, J., Nicholls, N., Peduzzi, P., Mechler, R., Bouwer, L.M., Arnell, N., Mach, K., Muir-Wood, R., Brakenridge, G.R., Kron, W., Benito, G., Honda, Y., Takahashi, K., Sherstyukov, B., 2014. Flood risk and climate change: global and regional perspectives. Hydrological Sciences Journal 59, 1–28.

Lacey, G., 1933. Uniform flow in alluvial rivers and canals, 237(1). Minutes of Proceedings of the Institution of Civil Engineers 421–453.

Lacey, G., 1939. Regime flow in incoherent alluvium. Central Board of Irrigation and Power, India.

Lane, E., 1955. Design of stable channels. Transactions of the American Society of Civil Engineers 120, 1234–1250.

Lane, S.N., Tayefi, V., Reid, S., Yu, D., Hardy, R., 2007. Interactions between sediment delivery, channel change, climate change and flood risk in a temperate upland environment. Earth Surface Processes and Landforms 32, 429–446.

Langbein, W., Schumm, S.A., 1958. Yield of sediment in relation to mean annual precipitation. Erosion and sediment yield 39, 1076–1084.

Langbein, W., Leopold, L.B., 1964. Quasi-equilibrium states in channel morphology. American Journal of Science 262, 782-294.

Langbein, W., 1964. Geometry of river channels. Journal of the Hydraulics Division, American Society of Civil Engineers 90, 301–312.

Laronne, J., Reid, I., Yitshak, Y., Frostick, L., 1994. The non-layering of gravel streambeds under ephemeral flood regimes. Journal of Hydrology 159, 353–363.

Lawler, D., Grove, J., 1999. Downstream change in river bank erosion rates in the Swale-Ouse system, northern England. Hydrological Processes 13, 977–992.

Lawler, D., 1993. The measurement of river bank erosion and lateral channel change: A review. Earth Surface Processes and Landforms 18, 777–821.

Lee, J., Julien, P.Y., 2006. Downstream hydraulic geometry of alluvial channels. Journal of Hydraulic Engineering 132, 1347–1352.

Leopold, L., 1968. Hydrology for urban land planning: A guidebook on the hydrologic effects of urban land use. Geological survey circular 554 1–18.

Leopold, L., Wolman, M., 1957. River channel patterns: braided, meandering, and straight. Geological Survey Professional Paper 282-B, 1–85.

Leopold, L.B., Maddock, T., 1953. The Hydraulic Geometry of Stream Channels and Some Physiographic Implications. U.S. Geological Survey Professional Paper 252, 1–57.

Levy, J., Birck, M.D., Mutiti, S., Kilroy, K.C., Windeler, B., Idris, O., Allen, L.N., 2011. The impact of storm events on a riverbed system and its hydraulic conductivity at a site of induced infiltration. Journal of environmental management 1–12.

Lindley, E.S., 1919. Regime canals. Proceedings of the Punjab Engineering Congress 7, 63–74.

Lins, H., Slack, J.R., 2005. Seasonal and Regional Characteristics of U.S. Streamflow Trends in the United States from 1940 to 1999. Physical Geography 26, 489–501.

Mackin, J., 1948. Concept of the graded river. Geological Society of America Bulletin 59, 463–512.

McCabe, G.J., Wolock, D.M., 2002. A step increase in streamflow in the conterminous United States. Geophysical Research Letters 29, 8–11.

Merwade, V., Olivera, F., Arabi, M., Edleman, S., 2008. Uncertainty in Flood Inundation Mapping: Current Issues and Future Directions. Journal of Hydrologic Engineering 13, 608–620.

Merz, B., Kundzewicz, Z.W., Delgado, J., Hundecha, Y., Kreibich, H., 2012. Detection and Attribution of Changes in Flood Hazard and Risk, in: Changes in Flood Risk in Europe. pp. 435–458.

Milliman, J.D., Syvitski, J.P.M., 1992. Geomorphic/Tectonic Control of Sediment Discharge to the Ocean: The Importance of Small Mountainous Rivers. The Journal of Geology 100, 525–544.

Milly, P.C.D., Betancourt, J., Falkenmark, M., Hirsch, R.M., Kundzewicz, Z.W., Lettenmaier, D.P., and Stouffer, R.J., 2008. Stationarity Is Dead: Whither Water Management? Science 319, no. 5863: 573–574.

Mitchell, T., Jones, P., 2005. An improved method of constructing a database of monthly climate observations and associated high-resolution grids. International journal of climatology 25, 693–712.

Molnar, P., 2001. Climate change, flooding in arid environments, and erosion rates. Environmental Sciences 1071–1074.

Molnar, P., Anderson, R.S., Kier, G., Rose, J., 2006. Relationships among probability distributions of stream discharges in floods, climate, bed load transport, and river incision. Journal of Geophysical Research 111, 1–10.

Mosley, M.P., 1981. Semi-determinate hydraulic geometry of river channels, South Island, New Zealand. Earth Surface Processes and Landforms 6, 127–137.

Mueller, D.S., Wagner, C.R., 2009. Measuring discharge with acoustic Doppler current profilers from a moving boat. U. S. Geological Survey Techniques and Methods, 72.

Nanson, G.C., Hickin, E.J., 1986. A statistical analysis of bank erosion and channel migration in western Canada. Geological Society of America Bulletin 97, 497–504.

Napolitano, M., 1998. Persistence of historical logging impacts on channel form in mainstem North Fork Caspar Creek. General Technical Report PSW-GTR-168-Web, United States Department of Agriculture, Forest Service 1–11.

National Oceanic and Atmospheric Administration, 2014. National Weather Service, http://water.weather.gov/ahps/download.php.

National Weather Service, 2014. Glossary - Flood Stage, http://w1.weather.gov/glossary/index.php?word=Flood+Stage.

Neal, J., Keef, C., Bates, P., Beven, K., Leedal, D., 2013. Probabilistic flood risk mapping including spatial dependence. Hydrological Processes 27, 1349–1363.

Neuhold, C., Stanzel, P., Nachtnebel, H.P., 2009. Incorporating river morphological changes to flood risk assessment: uncertainties, methodology and application. Natural Hazards and Earth System Science 9, 789–799.

Nicholas, A. P., Ashworth, P. J., Kirkby, M. J., Macklin, M. G., & Murray, T. 1995. Sediment slugs: large-scale fluctuations in fluvial sediment transport rates and storage volumes. Progress in physical geography, 19(4), 500-519.

O'Connor, J.E., 2004. Spatial distribution of the largest rainfall-runoff floods from basins between 2.6 and 26,000 km 2 in the United States and Puerto Rico. Water Resources Research 40, 1–11.

Ockelford, A.-M., Haynes, H., 2012. The impact of stress history on bed structure. Earth Surface Processes and Landforms 38, 717–727.

Odgaard, A.J., 1987. Streambank erosion along two rivers in Iowa. Water Resources Research 23, 1225–1236.

Osterkamp, W., Friedman, J., 2000. The disparity between extreme rainfall events and rare floods— with emphasis on the semi-arid American West. Hydrological Processes 2829, 2817–2829.

Paola, C., Voller, V.R., 2005. A generalized Exner equation for sediment mass balance. Journal of Geophysical Research 110, 1–8.

Parker, G., 1978a. Self-formed straight rivers with equilibrium banks and mobile bed. Part 2. The gravel river. Journal of Fluid Mechanics 89, 127–146.

Parker, G., 1978b. Self-formed straight rivers with equilibrium banks and mobile bed. Part 1. The sand-silt river. Journal of Fluid Mechanics 89, 109–125.

Parker, G., 1979. Hydraulic geometry of active gravel rivers. Journal of the Hydraulics Division 105, 1185–1201.

Parker, G., Wilcock, P.R., Paola, C., Dietrich, W.E., Pitlick, J., 2007. Physical basis for quasi-universal relations describing bankfull hydraulic geometry of single-thread gravel bed rivers. Journal of Geophysical Research 112, 1–21.

Pickup, G., Warner, R.F., 1976. Effects of hydrologic regime on magnitude and frequency of dominant discharge. Journal of Hydrology 29, 51–75.

Piégay, H., Alber, A., Slater, L.J., Bourdin, L., 2009. Census and typology of braided rivers in the French Alps. Aquatic Sciences 71, 371–388.

Pinter, N., Heine, R. a., 2005. Hydrodynamic and morphodynamic response to river engineering documented by fixed-discharge analysis, Lower Missouri River, USA. Journal of Hydrology 302, 70–91.

Pinter, N., Ickes, B.S., Wlosinski, J.H., van der Ploeg, R.R., 2006a. Trends in flood stages: Contrasting results from the Mississippi and Rhine River systems. Journal of Hydrology 331, 554–566.

Pinter, N., van der Ploeg, R.R., Schweigert, P., Hoefer, G., 2006b. Flood magnification on the River Rhine. Hydrological Processes 20, 147–164.

Pitlick, J., 1994. Relation between peak flows, precipitation, and physiography for five mountainous regions in the western USA. Journal of Hydrology 158, 219–240.

Pizzuto, J.E., 1994. Channel adjustments to changing discharges, Powder River, Montana. Geological Society of America Bulletin 106, 1494–1501.

Poff, N., Allan, J., Bain, M., Karr, J., 1997. The natural flow regime. BioScience 47, 769–784.

Powell, G.E., Mecklenburg, D., Ward, A., 2006. Evaluating channel-forming discharges: A study of large rivers in Ohio. Transactions of the ASABE 49, 35–46.

PRISM Climate Group, 2014. Oregon State University, http://prism.oregonstate.edu.

Rantz, S.E., 1982a. Measurement and Computation of Streamflow. Volume 1. Measurement of Stage and Discharge, in: US Geological Survey, Water-Supply Paper 2175. Reston, Virginia, pp. 1–284.

Rantz, S.E., 1982b. Measurement and Computation of Streamflow. Volume 2. Computation of Discharge, in: US Geological Survey, Water-Supply Paper 2175. U.S. Geol. Surv., Reston, Virginia, pp. 285–631.

Raven, E., Lane, S.N., Ferguson, R., 2009. The spatial and temporal patterns of aggradation in a temperate, upland, gravel bed river. Earth Surface 1197, 1181–1197.

Reiners, P.W., Ehlers, T. a, Mitchell, S.G., Montgomery, D.R., 2003. Coupled spatial variations in precipitation and long-term erosion rates across the Washington Cascades. Nature 426, 645–7.

Richards, K.S., 1976. Complex width-discharge relations in natural river sections. Geological Society of America Bulletin 87, 199–206.

Ripley, B.D., 2014. Loess: Local Polynomial Regression Fitting, R package "Stats", http://stat.ethz.ch/R-manual/R-patched/library/stats/html/loess.html.

Rus, D., Dietsch, B., Simon, A., 2003. Streambed adjustment and channel widening in eastern Nebraska. USGS Water-resources Investigations report 03-4003 1–65.

Rutherfurd, I., Anderson, B., Ladson, A., 2006. Managing the effects of riparian vegetation on flooding, in: S. Lovett, P. Price, Principles for Riparian Lands Management. Land and Water Australia, Canberra, pp. 63–84.

Sadler, P., 1981. Sediment accumulation rates and the completeness of stratigraphic sections. The Journal of Geology 89, 569–584.

Sadler, P., 1999. The influence of hiatuses on sediment accumulation rates. GeoResearch Forum 5, 15–40.

Schmidt, J.C., Wilcock, P.R., 2008. Metrics for assessing the downstream effects of dams. Water Resources Research 44, 1–19.

Schumm, S.A., 1960. The Shape of Alluvial Channels in Relation To Sediment Type. US Geol. Surv. Prof. Paper 352B, 17–30.

Schumm, S.A., 1969. River metamorphosis. Journal of the Hydraulics Division, American Society of Civil Engineers 95, 255–273.

Schumm, S.A., Lichty, R., 1965. Time, space, and causality in geomorphology. American Journal of Science 263, 110–119.

Sear, D., Newson, M., Brookes, A., 1995. Sediment-related river maintenance: The role of fluvial geomorphology. Earth Surface Processes and Landforms 20, 629–647.

Shields, F.D.J., Copeland, R.R., Klingeman, P.C., Doyle, M.W., Simon, A., 2003. Design for stream restoration. Journal of Hydraulic Engineering 575–584.

Shields, I.A., 1936. Application of similarity principles and turbulence research to bed-load movement, U.S. Soil Conservation Service Coop. Lab., in: Ott, W.P., van Uchelen, J.C. (Eds.), (Translators), Hydrodynamics Laboratory Publication, Vol. 167. California Institute of Technology, Pasadena.

Shroder, J., 1980. Dendrogeomorphology review and new techniques of tree-ring dating. Progress in Physical Geography 4, 161–188.

Simon, A., 1989. A model of channel response in disturbed alluvial channels. Earth Surface Processes and Landforms 14, 11–26.

Simon, A., 1994. Gradation processes and channel evolution in modified West Tennessee streams: process, response, and form. U.S. Geological Survey Professional Paper 1470 1–84.

Simon, A., Thorne, C.R., 1996. Channel adjustment of an unstable coarse-grained stream: opposing trends of boundary and critical shear stress, and the applicability of extremal hypotheses. Earth Surface Processes and Landforms 21, 155–180.

Simon, A., Curini, A., Darby, S.E., Langendoen, E.J., 2000. Bank and near-bank processes in an incised channel. Geomorphology 35, 193–217.

Simon, A., Pollen, N., 2006. A model of streambank stability incorporating hydraulic erosion and the effects of riparian vegetation, in: Proceedings of the Eigth Federal Interagency Sedimentation Conference (8thFISC). pp. 870–877.

Singer, M.B., 2007. The influence of major dams on hydrology through the drainage network of the Sacramento River basin, California. River Research and Applications 72, 55–72.

Singer, M.B., 2010. Transient response in longitudinal grain size to reduced gravel supply in a large river. Geophysical Research Letters 37, 1–5.

Sklar, L., Dietrich, W.E., 1998. River longitudinal profiles and bedrock incision models: Stream power and the influence of sediment supply, in: Rivers over Rock: Fluvial Processes in Bedrock Channels. pp. 237–260.

Slater, L.J., Singer, M.B., 2013. Imprint of climate and climate change in alluvial riverbeds: Continental United States, 1950-2011. Geology 41, 595–598.

Slater, L.J., Singer, M.B., Kirchner, J.W., 2015. Hydrologic versus geomorphic drivers of trends in flood hazard. Geophysical Research Letters 42, 1–7.

Smelser, M.G., Schmidt, J.C., 1998. An assessment methodology for determining historical changes in mountain streams. United States Department of Agricuture, Forest Service. General Technical Report 1–32.

Smith, L.C., Pavelsky, T.M., 2008. Estimation of river discharge, propagation speed, and hydraulic geometry from space: Lena River, Siberia. Water Resources Research 44, 1–11.

Stark, C., Barbour, J.R., Hayakawa, Y.S., Hattanji, T., Hovius, N., Chen, H., Lin, C.-W., Horng, M.-J., Xu, K.-Q., Fukahata, Y., 2010. The climatic signature of incised river meanders. Science 327, 1497–501.

Stock, J.D., Montgomery, D.R., Collins, B.D., Dietrich, W.E., Sklar, L.S., 2005. Field measurements of incision rates following bedrock exposure:

Implications for process controls on the long profiles of valleys cut by rivers and debris flows. Geological Society of America Bulletin 117, 174–194.

Stover, S., Montgomery, D.R., 2001. Channel change and flooding, Skokomish River, Washington. Journal of Hydrology 243, 272–286.

Stromberg, J.C., Beauchamp, V.B., Dixon, M.D., Lite, S.J., Paradzick, C., 2007. Importance of low-flow and high-flow characteristics to restoration of riparian vegetation along rivers in arid south-western United States. Freshwater Biology 52, 651–679.

Strunk, H., 1997. Dating of geomorphological processes using dendrogeomorphological methods. Catena 31, 137–151.

Summerfield, M., Hulton, N., 1994. Natural controls of fluvial denudation rates in major world drainage basins. Journal of Geophysical Research 99, 13871–13883.

Syvitski, J.P.M., Vorosmarty, C.J., Kettner, A.J., Green, P., 2005. Impact of Humans on the Flux of Terrestrial Sediment. Science 308, 376–380.

Tena, A., Batalla, R.J., Vericat, D., López-Tarazón, J.A., 2011. Suspended sediment dynamics in a large regulated river over a 10-year period (the lower Ebro, NE Iberian Peninsula). Geomorphology 125, 73–84.

Thompson, C.J., Croke, J.C., Purvis-Smith, D., 2011. Floodplain sediment disconnectivity at a tributary junction and valley constriction site in the Fitzroy River basin, Queensland, Australia. Geomorphology 125, 293–304.

Thorne, C.R., 1982. Processes and Mechanisms of River Bank Erosion, in: Hey, R.D., Bathurst, J.C., Thorne, C.R. (Eds.), Gravel-Bed Rivers. John Wiley and Sons, Ltd., New York, pp. 227–259.

Trabucco, A., Zomer, R.J., 2009. Global Aridity Index (Global-Aridity) and Global Potential Evapo-Transpiration (Global-PET) Geospatial Database. CGIAR Consortium for Spatial Information. Published online, available from the CGIAR-CSI GeoPortal at http://www.cgiar-csi.org/.

Trimble, S.W., Mendel, A.C., 1995. The cow as a geomorphic agent — A critical review. Geomorphology 13, 233–253.

Tucker, G.E., Bras, R.L., 2000. A stochastic approach to modeling the role of rainfall variability in drainage basin evolution. Water Resources Research 36, 1953–1964.

Tucker, G.E., Slingerland, R.L., 1997. Drainage basin responses to climate change. Water Resources Research 33, 2031–2047.

Turcotte, D.L., Greene, L., 1993. A scale-invariant approach to flood-frequency analysis. Stochastic Hydrology and Hydraulics 7, 33–40.

U.S. Geological Survey, 2014a. Water Data for the Nation – National Water Information System: Web Interface, http://waterdata.usgs.gov/nwis.

U.S. Geological Survey, 2014b. Mineral Resources On-Line Spatial Data, Geologic maps of US states, http://tin.er.usgs.gov/geology/state.

U.S. Geological Survey, 2014c. USGS Surface-Water Daily Data for the Nation, http://waterdata.usgs.gov/nwis/dv/?referred_module=sw.

U.S. Geological Survey, 2014d. How Streamflow is Measured, http://water.usgs.gov/edu/measureflow.html.

U.S. Geological Survey, 2014e. Streamflow Measurements for the Nation, http://waterdata.usgs.gov/nwis/measurements.

U.S. Geological Survey, 2014f. Annual Water Data Reports, http://wdr.water.usgs.gov/.

U.S. Water Resources Council Hydrology Committee, 1981. Guidelines for determining flood flow frequency, Bulletin 17B. US Water Resources Council 29, 1–194.

USDA, 2007. Alluvial Channel Design, in: Stream Restoration Design, National Engineering Handbook. pp. 1–48.

USGS NSIP, 2011. National Streamflow Information Program Implementation Status Report 1–6.

Van Oldenborgh, G.J., 2014. KNMI Climate Explorer, http://climexp.knmi.nl.

Van Steeter, M.M., Pitlick, J., 1998. Geomorphology and endangered fish habitats of the upper Colorado River: 1. Historic changes in streamflow, sediment load, and channel morphology. Water Resources Research 34, 287–302.

Vanoni, V.A., 2006. Sedimentation Engineering. ASCE Manual of Practice 54, 1–431.

Villarini, G., Serinaldi, F., Smith, J.A., Krajewski, W.F., 2009. On the stationarity of annual flood peaks in the continental United States during the 20th century. Water Resources Research 45, 1–17.

Villarini, G., Smith, J.A., 2010. Flood peak distributions for the eastern United States. Water Resources Research 46, 1–17.

Villarini, G., Smith, J.A., Vecchi, G.A., 2013. Changing Frequency of Heavy Rainfall over the Central United States. Journal of Climate 26, 351–357.

Ward, R.C., Robinson, M., 1967. Principles of hydrology. McGraw-Hill, New York.

Whipple, K.X., Tucker, G.E., 1999. Dynamics of the stream-power river incision model: Implications for height limits of mountain ranges, landscape response timescales, and research needs. Journal of Geophysical Research 104, 17661–17674.

Wilby, R.L., Beven, K.J., Reynard, N.S., 2008. Climate change and fluvial flood risk in the UK: more of the same? Hydrological Processes 22, 2511–2523.

Williams, G.P., Wolman, M.G., 1984. Downstream Effects of Dams on Alluvial Rivers, in: Geological Survey Professional Paper 1286. U.S. Government Printing Office, Washington, D.C., pp. 1–83.

Wolman, M.G., 1967. A cycle of sedimentation and erosion in urban river channels. Geografiska Annaler 49A, 385–395.

Wolman, M.G., Gerson, R., 1978. Relative scales of time and effectiveness of climate in watershed geomorphology. Earth Surface Processes 3, 189–208.

Wolman, M.G., Miller, J., 1960. Magnitude and frequency of forces in geomorphic processes. The Journal of Geology 54–74.

Wong, J.S., Freer, J.E., Bates, P.D., Sear, D. a., Stephens, E.M., 2014. Sensitivity of a hydraulic model to channel erosion uncertainty during extreme flooding. Hydrological Processes 1–19.

Wynn, T., Mostaghimi, S., 2006. The effects of vegetation and soil type on streambank erosion, southwestern Virginia, USA. Journal of the American Water Resources Association 04154, 69–82.

Yu, B., Wolman, M., 1987. Some dynamic aspects of river geometry. Water Resources Research 23, 501–509.

Zaman, M. a., Rahman, A., Haddad, K., 2012. Regional flood frequency analysis in arid regions: A case study for Australia. Journal of Hydrology 475, 74–83.

Zimmerman, R.C., Goodlett, J.C., Comer, G.H., 1967. The influence of vegetation on channel form of small streams. Symposium on River Morphology, Publication No. 75. International Association of Hydrological Sciences 255–275.

8. Appendices

8.1. Chapter 2 Data

Sorted by USGS station ID (STAID)

Pages 176-187:

DA (km^2): drainage area, as delineated in the Gages II dataset basin boundary, upstream from each gaging station

Precip. (mm/y): mean annual precipitation averages, measured at the gage, from 800m PRISM data, 1971-2000 (http://www.prism.oregonstate.edu/)

Elev. (mASL): elevation measured at gage location from 100-m resolution National Elevation Dataset

Mean watershed slope (%): mean watershed slope derived from National Elevation Dataset

Ptrend (mm/y/y): precipitation trend through time, from CRU TS3.1 data

Basin relief (m): calculated as basin elevation maximum minus basin elevation minimum

Drainage density (km/km^2): total length of streams per upstream watershed area, from the National Hydrography Dataset (NHD) 100k streams

Lithology (group): category of lithology, based on assumed erodibility and degree of consolidation

Lithology (specific): dominant lithology, representing the greatest percentage area of upstream drainage area

Pages 187-197:

BE N msts: number of bed elevation measurements at each site

BE years: length of the trend in bed elevation

BE p: significance of the trend in bed elevation

BE type: whether the site is classified as bed elevation trend ($p<0.05$) or bed elevation variability ($p>0.05$)

BET (cm/y): trend in bed elevation

BEV (m): bed elevation variability

Q_{50}trend p: significance of the trend in Q_{50}

Q_{50}trend ($m^3/s/y$): trend in Q_{50}

Q_{90}trend p: significance of the trend in Q_{90}

Q_{90}trend ($m^3/s/y$): trend in Q_{90}

Q_{90}&Q_{50} years: number of complete years of data for both percentiles Q_{90} and Q_{50}

Q_{90}/Q_{50}: value for the variable Q_{90}/Q_{50}

Q_{90}/Q_{50} years: number of years of data for the variable Q_{90}/Q_{50}

Q_{50} (m^3/s): mean of annual 50th flow percentiles

Q_{90} (m^3/s): mean of annual 90th flow percentiles

note: *i.d. signifies insufficient data to compute (see filtering steps in Methods)*

STAID	DA (km^2)	Precip. (mm/y)	Elev. (mASL)	Mean watershed slope (%)	Ptrend (mm/y/y)	Basin relief (m)	Drainage density (km/km^2)	Lithology (group)	Lithology (specific)
01021480	77	117	52	3.3	2.45	145	0.76	Clastic sedim.	mudstone
01022260	162	128	41	3.0	2.45	343	0.74	Plutonics	granite
01022500	574	130	17	3.7	2.43	432	0.83	Plutonics	granite
01029200	445	103	161	3.9	2.14	355	0.52	Clastic sedim.	mudstone
01031300	304	121	176	7.0	2.33	622	0.70	Metamorphics	schist
01031500	769	114	110	6.5	2.33	681	0.74	Metamorphics	quartzite
01037380	39	123	42	4.2	2.61	214	0.96	Metamorphics	slate
01047000	909	106	94	11.5	2.40	1189	0.43	Metamorphics	quartzite
01052500	384	104	402	15.4	2.46	713	0.41	Metamorphics	slate
01054200	181	106	230	22.3	3.89	1234	0.38	Metamorphics	schist
01055000	251	119	189	16.1	3.89	960	0.38	Plutonics	granodiorite
01057000	191	105	146	11.7	3.89	590	0.41	Plutonics	granite
01064801	173	121	149	14.0	3.92	1063	1.02	Plutonics	tonalite
01075800	8	105	194	19.4	3.41	806	0.66	Plutonics	granofels
01078000	222	115	141	11.4	3.41	717	0.93	Plutonics	granofels
01086000	382	114	124	10.6	3.19	701	0.88	Plutonics	granofels
01091000	267	112	100	7.4	3.19	518	0.87	Plutonics	granofels
01115630	22	125	87	4.1	0.28	105	0.52	Plutonics	granite
01115670	11	125	97	3.9	0.28	94	0.39	Plutonics	granite
01115770	19	125	78	3.1	0.28	77	1.03	Plutonics	granite
01117370	50	129	41	3.6	0.28	117	0.92	Plutonics	granite
01117468	25	129	35	4.3	0.28	150	0.62	Plutonics	granitic gneiss
01118300	10	127	50	4.7	0.28	117	0.50	Plutonics	granitic gneiss
01121000	70	130	108	6.0	3.08	278	0.61	Plutonics	granofels
01123000	78	128	89	5.1	2.27	174	0.41	Metamorphics	schist
01130000	598	100	289	15.0	3.43	977	0.42	Plutonics	granodiorite
01134500	195	108	352	12.6	3.37	708	0.43	Metamorphics	slate
01135150	10	103	353	11.1	3.37	386	0.34	Carbonate	limestone
01135300	111	99	223	10.4	3.37	543	0.59	Carbonate	limestone
01137500	229	103	365	19.2	3.92	1548	0.49	Plutonics	granofels
01139000	246	96	147	11.2	3.71	880	0.45	Carbonate	limestone
01142500	82	106	212	14.9	3.55	506	0.72	Carbonate	limestone
01144000	1790	99	118	17.9	4.09	1030	0.67	Metamorphics	slate
01150900	61	135	424	21.7	3.55	921	0.45	Metamorphics	quartzite
01162500	50	118	260	4.9	3.13	273	0.50	Plutonics	granofels
01169000	231	125	144	12.4	3.21	573	0.72	Metamorphics	slate
01170100	107	127	144	13.6	3.21	589	0.99	Metamorphics	slate
01174565	33	129	175	9.2	3.13	229	0.77	Plutonics	granitic gneiss
01188000	11	135	217	4.2	2.19	121	0.17	Metamorphics	schist
01195100	15	127	17	4.1	1.97	132	1.20	Plutonics	gneiss
01198000	132	118	211	11.5	2.26	414	0.45	Metamorphics	slate
01208950	19	125	23	3.4	2.04	105	1.39	Metamorphics	schist
01208990	54	133	93	8.1	2.04	211	1.22	Plutonics	granitic gneiss
01333000	112	106	194	21.1	2.80	873	0.39	Metamorphics	slate
01333500	141	108	199	19.5	2.80	674	0.44	Clastic sedim.	shale
01343060	610	133	383	11.1	1.70	712	0.76	Metamorphics	paragneiss
01349711	13	132	627	32.5	2.65	604	0.31	Clastic sedim.	shale
01349810	74	109	420	26.7	2.67	809	0.29	Clastic sedim.	shale
01349840	5	127	665	25.1	2.67	547	0.45	Clastic sedim.	shale
01350080	84	101	391	12.1	2.67	653	0.26	Clastic sedim.	shale
01350140	44	96	324	11.8	2.67	528	0.26	Clastic sedim.	shale
01362200	169	123	306	28.0	2.65	871	0.28	Clastic sedim.	shale
01362497	43	132	211	16.8	2.65	567	0.19	Clastic sedim.	shale
01364959	14	139	519	21.7	2.65	646	0.29	Clastic sedim.	shale
01409810	219	117	8	0.5	2.89	56	0.94	Unconsol. sed.	alluvium
01413408	213	104	409	21.4	2.65	771	0.29	Clastic sedim.	shale
01413500	424	103	396	20.5	2.65	782	0.28	Clastic sedim.	shale
01414500	64	110	395	22.6	1.80	739	0.25	Clastic sedim.	shale
01415000	86	113	395	18.3	1.80	624	0.40	Clastic sedim.	shale
01421618	37	104	515	17.8	2.30	471	0.23	Clastic sedim.	shale
01422389	3	112	609	23.1	1.80	408	0.41	Clastic sedim.	shale
01422738	2	117	540	9.2	1.80	149	0.97	Clastic sedim.	shale
01422747	64	119	383	14.3	1.80	366	0.76	Clastic sedim.	shale
01423000	860	119	366	15.7	1.80	657	0.49	Clastic sedim.	shale
01434017	60	140	524	20.3	2.65	739	0.34	Clastic sedim.	shale
01434021	2	162	829	25.5	2.65	418	0.86	Clastic sedim.	shale
01440000	168	121	109	9.4	2.75	394	0.88	Clastic sedim.	siltstone
01440400	175	127	178	7.6	1.78	483	0.71	Clastic sedim.	sandstone
01460880	60	123	31	2.2	2.06	182	0.57	Clastic sedim.	arkose
01461300	70	123	25	3.1	2.06	192	0.87	Clastic sedim.	arkose
01466500	5	119	35	0.6	2.89	27	0.64	Unconsol. sed.	alluvium
01471875	148	117	82	7.8	1.33	285	0.67	Plutonics	gneiss
01484100	9	116	11	0.0	1.70	8	0.43	Unconsol. sed.	silt
01485000	138	115	5	0.0	1.61	17	0.81	Unconsol. sed.	silt
01485500	142	116	4	0.1	1.57	22	0.54	Unconsol. sed.	sand
01490000	41	111	2	0.1	1.34	15	0.78	Unconsol. sed.	sand
01491000	292	113	4	0.1	1.99	32	0.92	Unconsol. sed.	silt
01492000	15	112	8	0.2	1.34	13	0.57	Unconsol. sed.	sand
01493500	33	114	5	0.5	1.99	19	0.58	Unconsol. sed.	sand
01502500	1346	101	300	8.9	1.83	349	0.73	Clastic sedim.	shale
01510000	383	109	312	10.8	1.29	338	0.75	Clastic sedim.	shale
01516500	31	91	410	11.5	0.39	338	0.67	Clastic sedim.	sandstone

STAID	DA (km^2)	Precip. (mm/y)	Elev. (mASL)	Mean watershed slope (%)	Ptrend (mm/y/y)	Basin relief (m)	Drainage density (km/km^2)	Lithology (group)	Lithology (specific)
01518862	234	91	408	13.8	1.25	371	0.69	Clastic sedim.	shale
01525981	262	87	332	10.2	0.39	393	0.39	Clastic sedim.	shale
01527500	412	84	361	12.2	2.39	327	0.59	Clastic sedim.	shale
01539000	702	110	168	12.7	2.42	616	0.75	Clastic sedim.	siltstone
01542810	14	109	385	19.9	0.90	349	0.87	Clastic sedim.	sandstone
01543500	1778	112	231	18.3	0.90	513	0.83	Clastic sedim.	shale
01544500	355	105	315	21.1	0.90	446	0.81	Clastic sedim.	sandstone
01545600	120	103	239	18.3	0.90	451	0.53	Clastic sedim.	shale
01548500	1557	95	239	17.0	2.18	549	0.69	Clastic sedim.	sandstone
01549500	97	104	319	17.5	2.18	401	0.63	Clastic sedim.	sandstone
01550000	453	100	212	16.5	2.18	515	0.74	Clastic sedim.	shale
01552500	61	114	335	15.7	2.42	426	0.64	Clastic sedim.	sandstone
01557500	115	105	290	14.6	1.82	503	0.57	Clastic sedim.	siltstone
01564500	446	99	189	13.1	1.01	558	0.82	Clastic sedim.	siltstone
01566000	544	105	143	14.5	1.01	565	0.81	Clastic sedim.	siltstone
01567500	39	107	184	10.6	1.01	423	0.81	Clastic sedim.	black shale
01568000	534	108	131	13.4	2.45	557	0.78	Clastic sedim.	siltstone
01580000	244	117	79	6.3	1.89	249	0.83	Metamorphics	serpentinite
01581830	20	113	161	6.1	1.72	166	0.80	Metamorphics	schist
01583000	5	114	129	5.4	0.91	105	1.19	Metamorphics	schist
01583500	156	116	90	5.8	1.89	195	0.78	Metamorphics	serpentinite
01583580	4	117	101	6.6	0.91	102	0.79	Metamorphics	quartz-feldspar schist
01586610	73	113	140	5.9	1.65	158	0.89	Metamorphics	schist
01594950	6	126	743	10.5	1.25	227	0.64	Clastic sedim.	sandstone
01596500	125	104	490	16.7	1.57	429	0.76	Clastic sedim.	shale
01605500	464	90	532	20.7	1.47	859	0.53	Clastic sedim.	shale
01609000	386	94	170	14.7	1.58	672	0.96	Clastic sedim.	siltstone
01610155	266	97	137	12.3	1.58	479	0.86	Clastic sedim.	siltstone
01611500	1748	95	150	15.6	1.58	883	0.80	Clastic sedim.	siltstone
01613050	28	100	222	14.9	0.61	500	0.94	Clastic sedim.	siltstone
01613900	41	100	213	11.3	1.38	497	0.98	Clastic sedim.	shale
01632000	543	96	322	21.2	2.55	904	0.49	Clastic sedim.	siltstone
01632900	245	94	275	9.8	2.55	720	0.40	Carbonate	limestone
01634500	264	98	216	14.9	1.38	743	0.86	Clastic sedim.	shale
01636690	35	107	122	10.7	2.04	324	0.54	Metamorphics	quartzite
01639500	267	111	108	5.3	1.72	230	0.77	Metamorphics	schist
01641500	19	117	232	12.4	1.65	339	0.84	Metamorphics	quartzite
01644000	859	108	81	6.7	1.08	591	0.83	Plutonics	granulite
01658500	19	110	74	3.3	2.47	55	0.94	Metamorphics	phyllite
01661050	48	114	4	2.4	1.87	50	0.73	Unconsol. sed.	sand
01661800	19	115	10	1.9	2.49	46	0.76	Unconsol. sed.	sand
01662800	67	107	116	9.9	3.37	754	0.38	Plutonics	granulite
01664000	1605	111	91	10.0	3.37	1122	0.58	Metamorphics	mylonite
01665500	297	114	145	17.8	3.37	1027	0.59	Metamorphics	mylonite
01666500	463	115	86	10.8	3.37	1144	0.60	Metamorphics	phyllite
01667500	1210	114	68	10.4	3.37	1161	0.59	Metamorphics	mylonite
01669520	277	116	14	1.6	1.61	51	0.88	Unconsol. sed.	sand
02011400	408	102	529	18.9	1.33	822	0.30	Clastic sedim.	black shale
02011460	156	107	659	25.8	2.69	721	0.36	Clastic sedim.	siltstone
02013000	425	97	403	21.3	1.81	762	0.97	Clastic sedim.	siltstone
02014000	397	96	416	19.6	1.81	837	1.08	Clastic sedim.	black shale
02016000	1195	100	310	18.0	2.25	1024	0.58	Clastic sedim.	shale
02017500	276	102	382	17.3	1.81	943	1.15	Clastic sedim.	black shale
02018000	852	102	310	18.1	1.81	1023	1.08	Clastic sedim.	shale
02030500	586	112	88	3.8	1.38	286	0.94	Metamorphics	phyllite
02032640	280	115	113	13.7	2.55	976	0.63	Metamorphics	mylonite
02038850	22	115	165	4.0	1.38	140	0.91	Metamorphics	mylonite
02046000	289	116	41	2.3	-0.58	96	0.88	Plutonics	granite
02051000	145	115	112	3.4	-0.20	106	0.86	Metamorphics	phyllite
02053200	584	122	6	0.4	-0.49	43	0.70	Unconsol. sed.	clay or mud
02053800	281	97	417	18.2	1.19	777	0.92	Clastic sedim.	shale
02055100	31	108	376	8.2	1.68	391	1.20	Carbonate	limestone
02056900	298	118	285	13.3	1.68	803	1.09	Plutonics	granodiorite
02059500	485	110	197	10.5	1.68	667	1.13	Metamorphics	quartzite
02064000	428	115	141	4.7	1.30	309	0.93	Metamorphics	mica schist
02065500	253	116	126	4.4	1.30	163	1.00	Metamorphics	quartzite
02069700	221	124	284	12.9	2.74	700	0.84	Metamorphics	schist
02070000	271	120	250	8.0	2.74	638	0.87	Metamorphics	mica schist
02070500	673	120	220	9.2	2.74	759	0.86	Metamorphics	mica schist
02074500	289	116	157	4.6	2.74	211	1.02	Metamorphics	mica schist
02077200	122	118	147	4.0	1.71	103	0.68	Metamorphics	metamorphic rock
02081500	428	119	86	2.4	-0.55	136	0.98	Metamorphics	metamorphic rock
02082770	447	118	41	2.7	-0.01	131	0.95	Plutonics	granite
02084160	109	126	2	0.1	-0.05	18	0.78	Unconsol. sed.	clay or mud
02084557	56	128	7	0.0	-0.70	8	0.42	Unconsol. sed.	clay or mud
02091000	203	124	18	0.8	0.97	55	0.75	Unconsol. sed.	clay or mud
02092500	448	134	7	0.3	0.97	43	0.69	Unconsol. sed.	sand
02096846	20	120	168	3.5	0.84	75	0.92	Metamorphics	phyllite
02102908	20	121	68	3.1	0.08	96	0.65	Unconsol. sed.	sand
02105900	59	142	4	0.2	0.15	18	1.06	Unconsol. sed.	sand
02108000	1569	138	7	0.7	0.61	51	0.79	Unconsol. sed.	clay or mud
02110500	2908	139	5	0.2	0.44	38	0.72	Unconsol. sed.	sand

STAID	DA (km^2)	Precip. (mm/y)	Elev. (mASL)	Mean watershed slope (%)	Ptrend (mm/y/y)	Basin relief (m)	Drainage density (km/km^2)	Lithology (group)	Lithology (specific)
02111180	131	128	333	22.4	1.37	926	0.94	Plutonics	granitic gneiss
02111500	234	132	328	18.3	2.04	819	0.73	Plutonics	gneiss
02112120	322	129	302	17.4	2.04	883	0.83	Plutonics	gneiss
02112360	205	126	283	12.6	1.56	731	1.17	Plutonics	gneiss
02118500	401	120	225	7.9	0.60	484	1.06	Plutonics	biotite gneiss
02125000	145	122	147	3.6	0.79	121	0.53	Metamorphics	phyllite
02128000	273	121	134	4.0	1.07	177	1.00	Metamorphics	metased.ary rock
02137727	330	132	378	22.0	1.11	1340	0.93	Plutonics	granitic gneiss
02140991	522	127	306	20.5	1.11	1494	1.04	Plutonics	granitoid
02142000	72	128	338	13.9	1.37	414	0.88	Plutonics	biotite gneiss
02143000	217	126	280	13.0	1.37	637	0.96	Plutonics	biotite gneiss
02143040	66	131	358	15.7	-0.39	539	1.13	Metamorphics	mica schist
02147126	90	121	158	2.8	0.00	93	1.18	Metamorphics	metamorphic rock
02149000	204	144	290	17.1	-0.41	835	0.94	Plutonics	granitic gneiss
02152100	155	128	296	17.6	-0.41	611	0.93	Plutonics	granitic gneiss
02167450	580	121	119	3.0	2.09	170	0.54	Plutonics	granitoid
02177000	527	159	366	20.1	1.50	1109	0.91	Metamorphics	paragneiss
02178400	151	179	575	26.5	1.50	1086	0.91	Plutonics	granitic gneiss
02193340	88	122	129	2.9	1.52	90	0.83	Plutonics	granitic gneiss
02198100	79	120	58	1.6	-0.59	57	0.82	Clastic sedim.	sandstone
02198690	420	126	4	0.3	-1.60	39	0.56	Clastic sedim.	sandstone
02202600	590	124	10	0.3	-1.60	64	0.59	Clastic sedim.	sandstone
02204130	67	128	200	3.7	1.34	126	0.61	Plutonics	granitic gneiss
02212600	188	122	119	4.8	1.38	106	0.87	Plutonics	granitic gneiss
02216180	129	121	54	1.9	1.43	79	0.93	Clastic sedim.	sandstone
02221525	491	122	118	3.9	1.38	127	0.88	Plutonics	granitic gneiss
02228500	497	133	30	0.1	1.36	27	0.21	Unconsol. sed.	unconsolidated deposit
02231000	1748	135	13	0.6	1.36	55	0.22	Unconsol. sed.	sand
02231342	112	136	10	0.0	2.03	12	1.42	Carbonate	limestone
02236500	147	129	31	0.4	2.19	41	0.19	Unconsol. sed.	sand
02245500	348	133	8	0.8	1.26	68	0.53	Unconsol. sed.	sand
02246150	37	130	2	0.1	1.15	15	0.16	Unconsol. sed.	clay or mud
02266200	26	129	31	0.7	1.42	26	0.02	Unconsol. sed.	sand
02268390	119	132	19	0.9	1.91	73	0.18	Unconsol. sed.	sand
02295013	147	130	30	0.2	1.91	38	0.42	Unconsol. sed.	sand
02296500	886	130	9	0.1	1.90	48	0.74	Unconsol. sed.	sand
02297155	94	133	22	0.1	-0.12	20	0.53	Unconsol. sed.	sand
02297310	528	129	5	0.1	1.14	36	0.54	Unconsol. sed.	sand
02298123	541	129	8	0.0	1.90	19	1.19	Carbonate	limestone
02298530	15	135	16	0.2	1.14	14	0.40	Unconsol. sed.	clay or mud
02299950	174	135	16	0.2	1.14	33	0.64	Unconsol. sed.	sand
02300700	74	131	7	0.3	-0.12	37	0.55	Unconsol. sed.	clay or mud
02310147	9	133	4	0.1	-0.77	15	0.29	Unconsol. sed.	clay or mud
02312200	413	130	19	0.1	0.57	26	0.16	Carbonate	limestone
02313700	1032	145	0	0.3	1.68	50	0.17	Carbonate	limestone
02315000	5008	134	32	0.0	1.40	48	0.28	Unconsol. sed.	sand
02321000	465	134	27	0.2	0.87	51	0.29	Unconsol. sed.	sand
02322700	654	137	5	1.0	1.54	61	0.15	Carbonate	limestone
02324000	791	152	5	0.7	0.39	44	0.21	Carbonate	limestone
02324400	176	146	20	0.1	0.39	30	0.33	Unconsol. sed.	clay or mud
02326000	556	148	7	0.2	2.08	56	0.16	Carbonate	limestone
02327033	189	158	5	0.9	3.78	39	0.25	Unconsol. sed.	clay or mud
02327100	271	160	6	0.8	3.78	43	0.21	Unconsol. sed.	clay or mud
02330400	449	160	8	0.7	3.78	55	0.37	Unconsol. sed.	clay or mud
02331000	392	158	386	16.6	0.88	967	0.93	Plutonics	granitic gneiss
02342933	290	134	71	3.2	2.23	143	1.29	Unconsol. sed.	sand
02343225	762	134	66	4.7	1.75	138	0.84	Unconsol. sed.	sand
02343940	168	141	45	1.1	1.16	53	0.85	Carbonate	limestone
02350600	482	128	102	3.8	1.89	144	0.87	Unconsol. sed.	sand
02362240	55	149	64	3.4	1.80	83	0.83	Unconsol. sed.	clay or mud
02363000	1293	145	78	3.6	2.25	132	1.07	Unconsol. sed.	terrace
02365470	386	153	17	1.5	1.82	81	0.68	Unconsol. sed.	delta
02365769	212	164	8	2.6	1.82	77	1.08	Unconsol. sed.	delta
02369800	228	163	39	2.1	4.84	66	0.74	Unconsol. sed.	sand
02370000	534	166	24	2.2	4.84	83	0.86	Unconsol. sed.	sand
02371500	1293	150	69	3.4	4.33	135	1.00	Unconsol. sed.	terrace
02372250	1145	150	73	3.3	4.33	130	0.82	Unconsol. sed.	terrace
02373000	1214	158	51	2.5	5.09	125	0.96	n/a	n/a
02373000	2253	94	157	6.9	1.34	447	0.67	Unconsol. sed.	clay or mud
02374500	446	164	58	3.4	5.09	120	0.90	Unconsol. sed.	clay or mud
02381600	10	157	403	9.9	-0.23	301	1.08	Metamorphics	mica schist
02384540	21	152	330	21.8	-0.23	823	1.08	Metamorphics	slate
02388900	180	163	396	14.9	0.49	749	1.15	Metamorphics	mica schist
02390000	231	157	381	12.0	0.49	662	1.13	Metamorphics	mica schist
02395120	84	134	228	3.8	-0.76	114	0.88	Carbonate	limestone
02408540	682	143	126	6.8	2.35	479	0.86	Metamorphics	phyllite
02422500	528	143	62	4.7	2.49	173	0.99	Unconsol. sed.	sand
02427250	675	147	43	3.2	3.96	136	1.05	Unconsol. sed.	clay or mud
02429980	5	151	139	4.2	1.71	58	0.79	Unconsol. sed.	sand
02430085	41	151	114	4.1	1.71	84	1.10	Unconsol. sed.	sand
02430615	29	150	101	4.9	1.71	70	1.11	Unconsol. sed.	sand
02430880	48	151	92	4.9	1.71	74	1.24	Unconsol. sed.	sand

STAID	DA (km^2)	Precip. (mm/y)	Elev. (mASL)	Mean watershed slope (%)	Ptrend (mm/y/y)	Basin relief (m)	Drainage density (km/km^2)	Lithology (group)	Lithology (specific)
02438000	724	154	112	6.7	3.36	174	0.99	Clastic sedim.	shale
02448900	412	143	33	1.1	3.31	115	1.16	Unconsol. sed.	beach sand
02464146	16	149	91	5.0	2.77	109	0.90	Clastic sedim.	shale
02464360	149	147	69	5.1	3.77	104	0.73	Clastic sedim.	shale
02465493	83	143	51	6.9	1.63	133	0.82	Unconsol. sed.	sand
02467500	1574	143	34	3.2	1.63	163	1.09	Unconsol. sed.	sand
02469800	423	148	15	4.5	1.70	145	1.00	Unconsol. sed.	sand
02470072	28	151	91	3.0	1.70	64	0.76	Unconsol. sed.	clay or mud
02472000	1927	152	66	2.5	2.24	130	1.17	Unconsol. sed.	clay or mud
02472500	790	158	57	2.4	2.24	118	1.07	Unconsol. sed.	sand
02472850	664	156	65	2.6	2.24	113	1.11	Unconsol. sed.	sand
02479155	137	164	33	2.4	1.13	68	1.03	Unconsol. sed.	sand
02479300	1144	169	9	1.9	3.33	113	1.11	Unconsol. sed.	sand
02479560	1454	167	21	2.5	3.33	102	0.91	Unconsol. sed.	terrace
02479945	82	167	37	3.5	1.59	71	0.77	Unconsol. sed.	sand
02483500	5127	147	95	2.1	4.96	126	1.09	Unconsol. sed.	clay or mud
02488700	352	156	57	2.7	2.70	112	1.01	Unconsol. sed.	sand
03010655	254	103	450	15.9	1.25	320	0.86	Clastic sedim.	siltstone
03011800	100	119	474	7.6	2.30	229	0.79	Clastic sedim.	sandstone
03017500	601	113	377	11.2	2.30	276	0.68	Clastic sedim.	siltstone
03021350	240	118	401	4.9	0.33	171	0.57	Clastic sedim.	siltstone
03022540	79	114	373	3.7	0.99	139	0.87	Clastic sedim.	siltstone
03025000	423	112	310	5.7	-0.42	216	0.75	Clastic sedim.	siltstone
03026500	20	119	516	7.0	2.30	166	0.90	Clastic sedim.	sandstone
03028000	161	116	459	10.8	2.30	245	0.90	Clastic sedim.	sandstone
03049000	357	103	243	9.2	1.36	232	0.86	Clastic sedim.	shale
03050000	487	123	610	21.1	0.87	856	0.85	Clastic sedim.	siltstone
03065000	898	138	530	20.5	0.93	955	0.74	Clastic sedim.	siltstone
03065400	142	145	953	9.5	1.25	382	0.78	Carbonate	limestone
03068800	388	128	652	19.7	0.87	827	0.64	Clastic sedim.	shale
03069500	1857	132	483	18.7	0.93	997	0.74	Clastic sedim.	siltstone
03069870	2351	142	426	19.7	0.93	1054	0.76	Clastic sedim.	siltstone
03070500	517	122	483	10.6	2.07	533	0.82	Clastic sedim.	shale
03076600	127	116	476	13.8	1.57	444	0.71	Clastic sedim.	shale
03078000	161	115	649	8.6	1.57	295	0.59	Clastic sedim.	shale
03114500	1187	113	193	17.6	0.84	308	0.84	Clastic sedim.	sandstone
03115400	544	110	200	13.3	0.84	227	1.00	Clastic sedim.	siltstone
03121850	31	103	283	6.8	1.23	118	0.58	Clastic sedim.	siltstone
03140000	70	98	243	8.2	1.23	156	0.66	Clastic sedim.	siltstone
03144000	363	101	231	7.1	1.89	146	0.80	Clastic sedim.	shale
03154000	531	115	222	18.9	1.10	267	0.95	Clastic sedim.	shale
03158200	295	102	201	9.6	1.66	146	0.97	Clastic sedim.	siltstone
03159540	401	104	182	8.5	1.29	129	1.03	Clastic sedim.	siltstone
03161000	528	130	812	17.0	2.04	889	0.83	Plutonics	granitic gneiss
03164000	2953	111	693	16.2	0.96	1076	0.87	Plutonics	granitoid
03165000	102	113	727	9.6	0.96	358	0.81	Plutonics	gneiss
03167500	691	101	579	12.5	0.96	620	0.81	Plutonics	biotite gneiss
03170000	795	99	569	11.0	1.19	520	0.89	Plutonics	biotite gneiss
03173000	773	101	512	16.5	1.11	722	0.92	Clastic sedim.	shale
03180500	345	116	828	20.3	0.87	577	0.79	Clastic sedim.	siltstone
03182500	1365	117	640	19.6	1.33	842	0.60	Clastic sedim.	siltstone
03186500	330	140	679	22.4	1.44	761	0.70	Clastic sedim.	shale
03187000	611	139	616	21.4	1.44	818	0.73	Clastic sedim.	shale
03187500	207	140	649	21.6	1.44	756	0.74	Clastic sedim.	shale
03201902	530	104	204	8.7	0.71	138	1.04	Clastic sedim.	siltstone
03207965	17	118	248	35.1	0.21	436	0.78	Clastic sedim.	shale
03213700	2425	117	192	29.9	0.21	861	0.80	Clastic sedim.	shale
03228750	170	98	289	0.8	0.84	84	1.06	Clastic sedim.	sandstone
03237255	554	114	170	15.2	1.12	264	1.04	Clastic sedim.	shale
03237500	1003	112	159	5.1	1.12	247	0.95	Clastic sedim.	black shale
03238500	569	114	193	1.3	1.78	173	1.00	Clastic sedim.	shale
03241500	171	101	272	0.7	2.19	91	0.63	Carbonate	limestone
03251200	583	114	194	6.0	1.78	184	0.80	Clastic sedim.	shale
03252300	400	117	240	4.8	1.16	104	0.76	Carbonate	limestone
03272700	177	103	254	0.9	3.06	121	0.81	Carbonate	limestone
03280700	158	125	268	28.8	0.37	472	0.88	Clastic sedim.	shale
03281040	401	121	266	26.2	0.37	474	0.85	Clastic sedim.	shale
03281100	423	128	255	23.4	0.37	420	0.88	Clastic sedim.	shale
03282040	201	123	222	10.9	0.32	207	0.84	Clastic sedim.	shale
03282500	171	117	271	11.4	0.32	174	0.84	Clastic sedim.	shale
03285000	822	122	246	6.0	1.10	243	0.71	Carbonate	limestone
03291780	71	115	203	3.5	1.50	125	0.53	Carbonate	limestone
03300400	1129	125	167	5.1	1.59	245	0.82	Carbonate	limestone
03302050	11	119	134	12.4	1.60	136	0.55	Clastic sedim.	shale
03302110	256	122	141	2.8	1.60	173	0.36	Carbonate	limestone
03302680	50	116	219	3.5	2.11	102	0.51	Clastic sedim.	siltstone
03338780	692	98	186	0.5	2.64	85	0.62	Clastic sedim.	siltstone
03340800	358	106	209	0.9	3.81	18	0.40	Clastic sedim.	siltstone
03357330	340	107	241	0.8	1.74	31	0.37	Clastic sedim.	siltstone
03357350	8	108	256	1.4	1.74	34	0.40	Clastic sedim.	siltstone
03364500	237	110	212	0.9	2.21	126	0.41	Carbonate	limestone
03384450	111	123	121	6.8	0.35	211	0.96	Clastic sedim.	sandstone

STAID	DA (km^2)	Precip. (mm/y)	Elev. (mASL)	Mean watershed slope (%)	Ptrend (mm/y/y)	Basin relief (m)	Drainage density (km/km^2)	Lithology (group)	Lithology (specific)
03408500	990	139	335	24.4	0.73	744	0.78	Clastic sedim.	shale
03409500	704	138	380	7.1	0.73	535	0.96	Clastic sedim.	shale
03410210	2088	138	266	15.6	0.90	809	0.88	Clastic sedim.	shale
03413200	118	133	246	15.6	0.90	277	0.61	Carbonate	limestone
03416000	274	137	227	15.5	0.90	330	0.82	Unconsol. sed.	clay or mud
03424730	555	140	157	14.3	1.93	479	0.90	Unconsol. sed.	clay or mud
03427500	677	140	162	9.0	0.20	479	0.92	Carbonate	limestone
03431800	252	132	127	6.1	0.66	166	0.87	Unconsol. sed.	clay or mud
03436690	267	135	135	6.2	2.88	157	0.97	Unconsol. sed.	gravel
03439000	179	187	667	20.9	0.38	1157	0.94	Plutonics	quartz diorite
03441000	104	165	646	28.1	1.62	1181	1.00	Plutonics	quartz diorite
03455500	73	141	918	33.9	0.96	1021	0.79	Plutonics	gneiss
03456500	133	114	831	31.7	1.62	1063	0.94	Plutonics	gneiss
03460000	127	131	750	30.8	0.96	1102	0.95	Metamorphics	quartzite
03463300	112	147	814	30.8	1.11	1209	0.93	Plutonics	gneiss
03465500	2082	118	467	25.3	0.14	1572	0.94	Plutonics	granitic gneiss
03471500	198	114	641	17.9	1.21	773	0.87	Clastic sedim.	shale
03473000	785	110	596	18.2	1.21	1197	1.01	Clastic sedim.	shale
03479000	236	111	801	21.4	1.73	1003	1.02	Plutonics	granitoid
03488000	578	115	533	20.0	1.21	919	0.80	Clastic sedim.	shale
03491000	124	114	373	15.5	-0.30	374	0.83	Clastic sedim.	shale
03497300	271	139	339	31.1	-0.30	1686	1.01	Metamorphics	metased.ary rock
03498500	697	128	261	21.5	-0.30	1764	1.10	Clastic sedim.	siltstone
03500000	361	140	622	22.6	1.50	972	0.82	Plutonics	granitic gneiss
03500240	146	141	616	25.5	1.50	1022	0.84	Plutonics	gneiss
03504000	135	181	972	26.9	0.32	725	0.87	Plutonics	gneiss
03535000	177	137	268	13.3	0.26	316	0.97	Carbonate	limestone
03539778	441	139	319	6.3	1.39	299	0.92	Clastic sedim.	sandstone
03544947	4	181	701	29.9	0.32	570	0.78	Plutonics	biotite gneiss
03574500	814	145	190	16.9	1.83	411	0.77	Carbonate	limestone
03588500	901	148	165	5.7	2.57	167	1.01	Volcanics	chert
03592718	67	150	134	3.6	1.68	104	1.07	Unconsol. sed.	sand
03597210	216	146	239	9.2	1.53	184	1.01	Unconsol. sed.	calcarenite
03597590	93	146	240	6.7	1.53	171	1.03	Unconsol. sed.	calcarenite
03604000	1163	146	165	5.4	2.31	173	0.97	Volcanics	chert
04015330	224	77	197	2.4	0.17	367	0.85	Plutonics	gabbro
04024430	1091	77	185	1.9	0.17	225	0.80	Clastic sedim.	shale
04027000	1620	83	207	3.5	-0.79	367	0.76	Volcanics	basalt
04033000	411	80	451	2.8	-0.26	113	0.38	Clastic sedim.	graywacke
04040500	420	85	374	2.2	-0.75	203	0.58	Clastic sedim.	graywacke
04043050	77	85	194	3.5	-0.64	255	0.90	Volcanics	basalt
04045500	1910	92	221	0.9	-1.26	140	0.39	Carbonate	limestone
04046000	76	80	207	0.5	-1.17	85	0.45	Carbonate	limestone
04056500	2946	79	194	0.6	-1.28	177	0.48	Carbonate	limestone
04057510	474	80	192	1.1	-0.41	117	0.34	Carbonate	limestone
04057800	116	84	468	4.0	-0.96	86	0.70	Clastic sedim.	graywacke
04059500	1184	73	210	1.6	0.37	280	0.37	Carbonate	limestone
04067958	1199	79	311	2.2	0.38	278	0.51	Volcanics	basalt
04073462	6	82	246	2.0	1.73	79	1.03	Clastic sedim.	sandstone
04074538	113	81	469	3.1	0.44	120	0.41	Metamorphics	mafic metavolcanic rock
04085119	36	77	242	0.7	0.78	59	0.88	Carbonate	dolostone (dolomite)
04085200	320	79	183	1.5	1.51	104	0.88	Carbonate	dolostone (dolomite)
04102776	215	93	187	0.8	3.75	66	0.74	Clastic sedim.	shale
04104945	124	91	255	1.6	1.70	46	0.54	Clastic sedim.	shale
04105700	98	94	248	2.2	1.70	63	0.39	Clastic sedim.	shale
04115265	96	85	242	1.5	1.46	74	0.49	Clastic sedim.	shale
04117000	20	89	257	2.2	1.88	47	0.83	Clastic sedim.	shale
04122200	1048	88	179	2.3	1.27	218	0.45	Clastic sedim.	shale
04122500	1769	87	183	2.4	1.96	255	0.40	Clastic sedim.	shale
04124000	2244	83	253	2.2	0.59	261	0.36	Clastic sedim.	shale
04124500	148	83	351	2.8	1.38	172	0.30	Clastic sedim.	shale
04125460	637	85	266	3.1	0.59	275	0.36	Clastic sedim.	shale
04126970	327	81	251	1.6	-0.19	161	0.32	Clastic sedim.	shale
04127918	548	83	190	0.7	-0.57	126	0.48	Carbonate	limestone
04136000	2882	81	304	1.6	-0.03	177	0.23	Clastic sedim.	shale
04150500	916	83	216	0.4	1.05	102	1.07	Clastic sedim.	shale
04161580	64	82	267	1.9	2.03	98	0.48	Clastic sedim.	shale
04185000	1064	89	211	0.9	1.66	180	0.81	Clastic sedim.	shale
04185440	11	92	234	0.7	1.57	30	1.29	Clastic sedim.	shale
04196800	608	93	243	0.3	1.35	67	0.90	Carbonate	dolostone (dolomite)
04197100	388	95	250	0.4	0.84	97	0.80	Clastic sedim.	black shale
04197170	95	94	226	0.8	0.84	70	0.98	Carbonate	limestone
04199155	60	92	179	1.6	1.61	109	0.78	Clastic sedim.	sandstone
04213000	455	103	186	2.1	0.18	231	1.07	Clastic sedim.	siltstone
04216418	196	97	294	5.6	3.22	347	1.11	Clastic sedim.	shale
04221000	751	92	449	10.9	1.25	332	0.53	Clastic sedim.	siltstone
04224775	232	84	222	10.2	2.39	431	0.65	Clastic sedim.	shale
04233300	98	96	242	9.8	1.91	377	0.87	Clastic sedim.	shale
04245200	85	104	220	8.9	1.89	394	0.86	Clastic sedim.	shale
04256000	232	113	299	5.1	2.84	413	0.80	Metamorphics	paragneiss
04268800	444	114	299	6.2	2.69	542	0.85	Metamorphics	metavolcanic rock
04273700	170	87	67	6.6	2.61	646	0.23	Plutonics	granitic gneiss

STAID	DA (km^2)	Precip. (mm/y)	Elev. (mASL)	Mean watershed slope (%)	Ptrend (mm/y/y)	Basin relief (m)	Drainage density (km/km^2)	Lithology (group)	Lithology (specific)
04273800	177	83	75	6.5	2.61	568	0.42	Metamorphics	metavolcanic rock
04276842	135	93	74	10.2	2.33	634	0.50	Metamorphics	quartzite
04280350	181	106	170	20.2	2.60	973	0.30	Metamorphics	slate
04282525	301	94	88	14.3	3.55	1159	0.36	Metamorphics	schist
04282650	151	90	54	6.8	4.14	394	0.30	Carbonate	limestone
04282780	199	91	52	12.8	4.14	723	0.38	Metamorphics	slate
04296000	302	106	218	9.8	3.37	585	0.53	Carbonate	limestone
05056000	4862	48	424	1.4	1.15	270	0.22	Unconsol. sed.	sand
05056100	1164	43	446	0.5	1.17	231	0.52	Unconsol. sed.	silt
05057200	1897	51	408	0.5	0.96	117	0.21	Unconsol. sed.	sand
05059600	53	52	401	0.8	0.96	79	0.77	Unconsol. sed.	clay or mud
05062500	2407	59	323	1.3	1.31	301	0.53	Plutonics	granite
05123400	3206	44	440	1.2	1.23	326	0.34	Unconsol. sed.	silt
05129115	2358	68	365	2.9	0.58	239	0.49	Plutonics	granite
05132000	3895	67	362	0.8	-0.04	128	0.39	Plutonics	granite
05212700	963	72	395	1.3	-0.17	131	0.44	Plutonics	granite
05291000	1047	57	307	1.4	0.83	329	1.10	Unconsol. sed.	sand
05293000	1185	58	299	1.2	0.83	338	1.05	Clastic sedim.	shale
05311400	297	65	355	1.5	0.79	202	0.83	Clastic sedim.	shale
05317200	455	75	245	0.6	2.69	232	0.71	Clastic sedim.	shale
05362000	1477	81	341	1.3	1.67	254	0.55	Metamorphics	mafic metavolcanic rock
05383950	1466	87	260	2.8	1.02	182	0.93	Carbonate	limestone
05384500	342	85	231	5.8	0.94	184	0.94	Carbonate	limestone
05385500	712	86	213	7.4	0.94	210	0.95	Carbonate	limestone
05387500	1269	86	262	2.6	1.38	181	0.90	Carbonate	limestone
05389400	89	86	199	6.2	1.33	177	1.13	Clastic sedim.	shale
05393500	220	82	449	1.8	0.14	143	0.72	Metamorphics	mafic metavolcanic rock
05399500	576	82	355	1.3	1.30	108	0.82	Plutonics	granodiorite
05408000	689	88	239	10.9	1.35	203	0.90	Clastic sedim.	sandstone
05411850	1664	88	275	2.0	1.38	154	0.88	Carbonate	limestone
05412400	943	87	210	4.4	1.70	176	0.89	Carbonate	limestone
05412500	3858	86	198	3.7	1.70	230	0.91	Carbonate	limestone
05413500	695	86	183	6.3	1.02	196	1.02	Carbonate	dolostone (dolomite)
05414000	371	88	209	6.8	1.02	171	0.91	Carbonate	dolostone (dolomite)
05420680	897	91	304	1.1	1.23	124	0.87	Carbonate	limestone
05444000	376	94	203	2.4	1.61	121	0.87	Carbonate	limestone
05451210	581	87	289	0.8	2.57	95	0.47	Carbonate	limestone
05454000	65	93	213	2.8	0.91	60	0.89	Carbonate	limestone
05458000	777	89	302	1.0	1.33	138	0.78	Carbonate	limestone
05464220	775	90	257	1.7	1.56	88	0.80	Carbonate	limestone
05466500	1152	90	168	2.0	0.79	101	0.84	Clastic sedim.	shale
05473450	162	94	198	0.6	0.59	52	0.63	Carbonate	limestone
05488200	234	90	226	3.7	1.50	92	0.88	Clastic sedim.	shale
05489000	965	92	213	4.5	1.50	104	0.97	Clastic sedim.	shale
05494300	226	96	229	2.8	2.07	76	0.82	Clastic sedim.	shale
05495500	906	97	153	1.6	1.98	90	0.83	Carbonate	limestone
05503800	213	99	201	1.3	2.72	52	0.78	Carbonate	limestone
05506100	472	100	198	0.8	2.71	89	0.90	Carbonate	limestone
05507600	275	100	211	0.7	2.72	47	0.85	Carbonate	limestone
05514500	2407	98	144	2.1	3.01	148	1.06	Carbonate	limestone
05525500	1159	97	191	0.3	2.64	87	0.72	Clastic sedim.	siltstone
05556500	505	97	171	0.9	1.77	132	1.02	Clastic sedim.	shale
05584500	1696	96	156	1.3	1.98	107	0.77	Clastic sedim.	shale
05585000	3355	97	137	1.7	1.08	110	0.80	Clastic sedim.	shale
05591550	96	100	192	0.3	3.05	44	0.70	Clastic sedim.	shale
05592050	254	101	172	0.7	2.39	59	0.76	Clastic sedim.	shale
05592575	115	101	155	1.0	1.95	39	0.81	Clastic sedim.	shale
05593575	218	104	128	0.5	2.91	50	0.97	Clastic sedim.	shale
05593900	145	101	179	0.8	1.95	59	0.88	Clastic sedim.	shale
05595730	237	110	128	0.9	1.62	55	1.03	Clastic sedim.	shale
06036905	677	89	2155	7.5	-0.81	550	0.43	Volcanics	rhyolite
06037500	1126	62	2023	8.9	-0.81	823	0.38	Volcanics	rhyolite
06043500	2120	53	1580	28.2	-0.22	1851	0.74	Metamorphics	metamorphic rock
06073500	835	36	1161	22.9	0.16	1597	1.38	Clastic sedim.	clastic
06078500	670	56	1497	29.0	-0.39	1391	0.57	Carbonate	carbonate
06102500	287	52	1448	39.5	-0.22	1356	0.56	Carbonate	carbonate
06183800	327	35	603	2.4	0.04	162	0.74	Clastic sedim.	shale
06183850	310	34	597	2.5	0.04	211	0.48	Clastic sedim.	shale
06187915	73	66	2257	36.2	0.17	1118	0.54	Metamorphics	metamorphic rock
06187950	261	39	2026	34.4	0.17	1343	0.39	Metamorphics	metamorphic rock
06190540	512	36	1732	17.2	-0.54	1594	0.42	Volcanics	rhyolite
06191000	514	35	1718	17.3	-0.54	1608	0.42	Volcanics	rhyolite
06191500	6784	30	1554	21.2	-0.54	2139	0.50	Unconsol. sed.	mixed clastic/volcanic
06218500	597	35	2233	18.6	-0.12	1428	0.75	Unconsol. sed.	mixed clastic/volcanic
06221400	228	31	2011	36.8	-0.12	2197	0.58	Plutonics	granitoid
06224000	485	27	1800	31.9	-0.29	2379	0.43	Plutonics	granitoid
06278300	59	75	2767	18.8	0.14	740	0.48	Plutonics	granitoid
06289000	471	48	1322	26.7	0.08	1731	0.56	Carbonate	limestone
06291500	218	46	1274	19.8	0.25	1711	0.57	Clastic sedim.	shale
06299500	97	47	1384	24.0	0.10	1703	0.51	Plutonics	granitoid
06301480	9	72	2649	18.2	0.10	659	0.69	Plutonics	granitoid
06332515	191	40	614	5.3	0.33	252	0.91	Unconsol. sed.	silt

STAID	DA (km^2)	Precip. (mm/y)	Elev. (mASL)	Mean watershed slope (%)	Ptrend (mm/y/y)	Basin relief (m)	Drainage density (km/km^2)	Lithology (group)	Lithology (specific)
06336600	1556	37	726	3.2	0.08	321	0.65	Clastic sedim.	shale
06339100	529	41	664	3.4	0.15	281	0.99	Unconsol. sed.	silt
06339500	3171	42	567	3.4	0.15	374	0.88	Unconsol. sed.	silt
06342450	286	44	516	2.5	0.77	171	0.84	Unconsol. sed.	silt
06344600	402	42	769	1.6	0.14	117	1.04	Unconsol. sed.	silt
06347000	617	44	597	1.9	0.28	249	0.82	Unconsol. sed.	silt
06347500	1135	45	575	3.7	0.28	205	0.99	Unconsol. sed.	silt
06351200	4225	42	570	2.3	0.28	479	0.95	Unconsol. sed.	silt
06352000	1442	42	757	1.7	0.40	305	0.91	Unconsol. sed.	silt
06353000	4527	42	579	2.2	0.28	482	0.92	Unconsol. sed.	silt
06360500	12655	45	509	2.9	0.82	716	1.09	Clastic sedim.	shale
06392900	26	64	1869	10.7	0.56	302	0.76	Clastic sedim.	sandstone
06402430	118	50	1262	13.1	0.27	604	0.85	Metamorphics	schist
06422500	244	52	1339	10.7	0.67	725	0.72	Metamorphics	quartzite
06424000	57	61	1489	10.3	0.67	562	0.75	Metamorphics	quartzite
06430850	72	69	1547	12.1	0.57	544	0.66	Carbonate	limestone
06431500	427	57	1118	15.9	0.57	1056	0.81	Unconsol. sed.	clay or mud
06440200	649	44	685	2.0	0.45	300	1.11	Clastic sedim.	claystone
06441500	8153	48	437	3.3	1.04	552	1.09	Clastic sedim.	shale
06445980	974	46	916	5.7	-0.06	330	1.06	Clastic sedim.	mudstone
06446700	1095	46	760	3.9	0.27	322	1.03	Clastic sedim.	siltstone
06447000	12850	46	654	4.6	0.82	860	1.03	Clastic sedim.	mudstone
06447230	710	47	625	3.3	0.82	387	1.24	Clastic sedim.	siltstone
06447450	16086	49	543	4.4	0.87	964	1.07	Clastic sedim.	mudstone
06450500	4111	49	592	3.2	0.87	618	0.81	Clastic sedim.	mudstone
06452000	25791	54	419	4.0	1.03	1088	1.00	Clastic sedim.	mudstone
06453255	1524	62	396	1.1	0.78	183	0.43	Unconsol. sed.	clay or mud
06468170	2809	48	446	0.8	1.15	256	0.25	Unconsol. sed.	silt
06468250	3243	48	441	0.8	0.91	263	0.24	Unconsol. sed.	silt
06470800	1071	52	397	0.4	0.77	66	0.24	Unconsol. sed.	sand
06471200	1869	53	418	0.9	0.22	268	0.44	Unconsol. sed.	sand
06474000	3199	52	401	0.4	1.25	260	0.54	Unconsol. sed.	silt
06476500	670	56	405	1.1	1.07	224	0.82	Unconsol. sed.	clay or mud
06477500	1512	58	400	0.7	1.13	219	0.58	Unconsol. sed.	sand
06478540	200	62	461	0.5	1.31	67	0.37	Unconsol. sed.	sand
06479215	175	58	545	1.1	1.18	82	0.89	Unconsol. sed.	silt
06479438	952	57	530	1.0	1.19	100	0.65	Unconsol. sed.	silt
06479500	1713	57	524	1.1	1.19	116	0.58	Unconsol. sed.	silt
06614800	4	119	3188	34.2	0.20	617	0.85	Plutonics	plutonic rock (phaneritic)
06623800	188	81	2520	20.1	-0.31	953	0.59	Plutonics	granitoid
06632400	163	49	2375	16.1	0.16	1053	0.56	Unconsol. sed.	glacial drift
06821080	173	99	275	1.8	1.83	62	0.54	Carbonate	limestone
06846500	4358	55	771	1.9	0.70	613	0.60	Unconsol. sed.	silt
06847900	1536	57	714	1.7	-0.26	330	0.93	Unconsol. sed.	silt
06853800	589	71	494	2.5	-0.75	143	1.20	Unconsol. sed.	silt
06869950	672	81	375	3.4	0.79	179	1.17	Unconsol. sed.	gravel
06870300	304	82	380	2.4	0.79	111	1.27	Unconsol. sed.	gravel
06876700	1056	77	384	2.7	0.01	189	1.16	Unconsol. sed.	gravel
06878000	776	84	345	2.2	-0.37	145	1.21	Unconsol. sed.	gravel
06879650	12	88	339	6.7	-0.48	109	0.91	Clastic sedim.	shale
06885500	1063	86	346	2.5	-0.99	126	0.50	Unconsol. sed.	sand
06889160	129	91	337	2.6	1.15	91	1.24	Unconsol. sed.	sand
06897950	136	92	287	4.4	1.94	86	0.98	Carbonate	limestone
06899700	1004	98	217	2.9	2.58	118	0.71	Carbonate	limestone
06903400	481	93	285	2.4	2.03	72	0.78	Clastic sedim.	shale
06906150	59	99	253	1.5	2.50	44	0.75	Carbonate	limestone
06906800	1415	102	208	2.8	3.59	157	1.06	Carbonate	limestone
06910800	445	94	324	2.3	1.07	169	1.18	Clastic sedim.	shale
06917380	761	113	246	1.7	3.37	103	0.45	Carbonate	limestone
06918460	651	114	273	3.5	4.46	174	0.94	Carbonate	limestone
06919500	1069	111	230	2.5	3.89	134	0.71	Clastic sedim.	shale
06921070	713	114	292	3.7	3.61	202	1.03	Carbonate	limestone
06928300	428	111	300	5.9	3.53	178	0.93	Carbonate	limestone
06930000	1427	111	246	6.0	3.38	251	1.03	Carbonate	limestone
07014000	664	111	206	6.9	2.57	243	0.99	Carbonate	dolostone (dolomite)
07014500	3846	106	197	6.0	2.57	268	1.03	Carbonate	limestone
07030392	543	141	114	3.1	1.67	121	0.99	Unconsol. sed.	clay or mud
07030500	1303	138	93	2.5	1.67	142	1.09	Unconsol. sed.	clay or mud
07048800	361	119	347	11.4	1.94	372	0.80	Clastic sedim.	sandstone
07053250	136	113	304	5.5	2.69	281	0.87	Carbonate	limestone
07053810	507	110	219	11.1	2.69	221	1.12	Carbonate	limestone
07054080	773	111	247	7.4	2.96	272	1.01	Carbonate	limestone
07055646	153	125	359	17.2	1.11	430	0.85	Clastic sedim.	sandstone
07055875	175	123	311	15.0	0.90	371	0.94	Clastic sedim.	sandstone
07057500	1456	112	188	6.3	2.90	313	1.06	Carbonate	limestone
07058000	1475	112	184	8.7	2.96	353	1.04	Carbonate	limestone
07060710	150	121	169	13.7	2.32	280	1.14	Carbonate	limestone
07064533	763	115	241	6.5	2.04	219	1.07	Carbonate	dolostone (dolomite)
07067000	4349	122	138	8.2	2.04	351	1.06	Carbonate	limestone
07071500	2024	118	128	5.5	2.05	334	0.99	Carbonate	dolostone (dolomite)
07072000	2895	122	94	5.5	2.62	372	1.03	Carbonate	dolostone (dolomite)
07075300	325	132	156	15.5	0.90	473	0.93	Clastic sedim.	sandstone

STAID	DA (km^2)	Precip. (mm/y)	Elev. (mASL)	Mean watershed slope (%)	Ptrend (mm/y/y)	Basin relief (m)	Drainage density (km/km^2)	Lithology (group)	Lithology (specific)
07083000	61	42	3012	41.8	-0.37	1405	0.48	Plutonics	biotite gneiss
07142300	1820	67	601	0.5	1.02	190	0.48	Unconsol. sed.	silt
07145700	400	83	357	0.6	2.37	104	1.05	Unconsol. sed.	gravel
07148400	2545	74	398	2.5	1.50	344	1.11	Unconsol. sed.	silt
07149000	2291	75	393	2.6	1.64	326	1.23	Unconsol. sed.	silt
07151500	2109	83	343	0.9	2.37	270	1.14	Unconsol. sed.	sand
07167500	320	96	302	3.3	2.43	204	1.14	Clastic sedim.	shale
07180500	276	86	390	1.7	1.61	83	1.11	Clastic sedim.	shale
07184000	511	111	256	1.0	3.84	69	0.51	Clastic sedim.	shale
07188653	367	116	298	7.2	3.07	227	0.71	Carbonate	limestone
07189100	238	113	241	4.3	2.52	153	0.39	Carbonate	limestone
07191222	154	118	240	3.0	3.12	146	0.80	Carbonate	limestone
07195800	38	121	359	2.9	3.12	83	0.91	Carbonate	limestone
07196900	106	126	307	8.2	3.13	250	1.10	Clastic sedim.	sandstone
07197000	808	121	218	6.5	2.91	364	0.95	Clastic sedim.	shale
07208500	159	48	2055	18.3	0.87	1519	0.43	Volcanics	basalt
07226500	5243	42	1169	3.2	0.83	1373	0.37	Unconsol. sed.	alluvium
07247250	244	132	214	15.1	0.73	599	1.16	Clastic sedim.	shale
07252000	969	126	145	18.3	1.13	646	0.87	Clastic sedim.	sandstone
07257006	794	124	139	19.9	1.11	602	0.89	Clastic sedim.	sandstone
07260000	212	126	120	13.5	1.03	573	0.86	Clastic sedim.	sandstone
07261000	446	128	131	4.6	0.06	250	1.24	Clastic sedim.	sandstone
07263295	119	135	123	9.2	0.35	327	1.15	Clastic sedim.	shale
07290650	1689	151	29	2.7	4.29	127	1.21	Unconsol. sed.	sand
07295000	467	164	31	2.9	3.29	106	0.87	Unconsol. sed.	sand
07299670	828	68	440	0.8	1.87	154	0.39	Clastic sedim.	sandstone
07301410	770	60	682	1.9	0.26	262	0.42	Unconsol. sed.	terrace
07301500	6885	71	511	1.7	1.45	605	0.45	Unconsol. sed.	sand
07311600	1267	66	484	1.4	1.59	326	0.48	Clastic sedim.	mudstone
07311630	158	64	475	2.8	1.43	138	0.70	Clastic sedim.	sandstone
07311900	4772	69	353	2.1	1.72	442	0.57	Clastic sedim.	mudstone
07315200	502	82	258	1.5	1.64	107	0.58	Clastic sedim.	mudstone
07315700	1489	86	226	1.7	2.56	169	0.58	Clastic sedim.	shale
07335700	103	140	275	17.4	0.73	533	1.14	Clastic sedim.	shale
07340300	230	147	247	17.3	2.43	466	0.57	Clastic sedim.	shale
07342480	112	113	147	0.8	2.35	73	0.36	Unconsol. sed.	terrace
07346045	960	127	57	3.2	2.48	136	0.43	Unconsol. sed.	sand
07352800	245	141	42	0.9	3.84	66	0.49	Unconsol. sed.	sand
07359610	342	148	183	11.3	2.45	486	1.04	Clastic sedim.	shale
07360200	176	153	217	20.4	2.43	483	1.05	Clastic sedim.	shale
07362500	622	138	51	1.2	2.83	98	1.44	Unconsol. sed.	alluvium
07362587	70	146	243	10.6	0.35	326	0.99	Clastic sedim.	shale
07375000	249	169	22	1.7	0.29	77	0.94	Unconsol. sed.	clay or mud
07376000	652	168	10	1.5	0.29	125	1.18	Unconsol. sed.	sand
07377000	1525	164	51	1.8	3.29	106	1.01	Unconsol. sed.	sand
08013000	1294	158	38	1.5	1.25	105	1.17	Unconsol. sed.	clay or mud
08014500	1305	158	15	1.5	0.93	119	0.56	Unconsol. sed.	clay or mud
08023080	188	133	64	1.4	4.07	71	0.48	Unconsol. sed.	sand
08023400	211	135	67	1.7	3.79	56	0.45	Unconsol. sed.	sand
08029500	333	146	43	2.9	2.44	138	0.55	Unconsol. sed.	sand
08050800	101	101	198	2.1	2.70	89	0.49	Clastic sedim.	shale
08050840	76	103	204	0.9	2.70	71	0.51	Carbonate	limestone
08066200	364	132	38	2.3	1.99	100	0.74	Unconsol. sed.	clay or mud
08066300	384	136	30	1.2	2.23	113	0.48	Unconsol. sed.	terrace
08070200	989	134	20	1.5	2.14	136	0.73	Unconsol. sed.	terrace
08079600	3349	52	689	0.8	1.06	455	0.10	Unconsol. sed.	sand
08082700	276	67	415	0.5	1.74	83	0.59	Clastic sedim.	mudstone
08095300	470	88	168	1.7	2.45	202	0.36	Carbonate	limestone
08099300	698	74	374	1.5	2.84	265	0.48	Clastic sedim.	shale
08101000	1177	84	233	3.1	1.41	309	0.44	Unconsol. sed.	clay or mud
08103900	86	81	294	3.0	1.41	142	0.72	Unconsol. sed.	clay or mud
08104900	343	91	224	2.4	0.78	245	0.52	Unconsol. sed.	clay or mud
08109700	610	97	92	1.9	0.92	134	0.62	Clastic sedim.	mudstone
08128400	6665	53	615	1.2	1.19	294	0.18	Carbonate	limestone
08152900	957	81	488	3.5	0.81	216	0.51	Carbonate	limestone
08155200	233	88	227	4.7	-0.18	231	0.55	Carbonate	limestone
08158700	320	93	268	4.1	-0.18	242	0.43	Carbonate	limestone
08158810	32	91	265	4.1	-0.18	114	0.54	Carbonate	limestone
08164000	2124	109	7	1.2	3.33	176	0.56	Unconsol. sed.	clay or mud
08164300	862	107	60	1.9	3.17	126	0.51	Unconsol. sed.	clay or mud
08164600	254	106	13	0.3	1.88	60	0.52	Unconsol. sed.	sand
08166000	294	81	530	3.6	0.95	172	0.53	Carbonate	limestone
08171300	1067	93	196	5.3	-0.18	429	0.47	Carbonate	limestone
08175000	1422	93	61	1.3	0.88	169	0.60	Clastic sedim.	siltstone
08176900	925	95	45	1.2	1.88	144	0.75	Unconsol. sed.	sand
08177300	72	93	45	1.1	0.95	52	1.00	Unconsol. sed.	clay or mud
08178880	851	84	376	10.5	0.32	361	0.69	Carbonate	limestone
08186500	619	78	76	1.3	0.88	164	0.62	Clastic sedim.	siltstone
08189500	1808	99	6	0.9	0.76	159	0.59	Unconsol. sed.	sand
08190000	1961	66	357	9.8	0.62	388	0.58	Carbonate	limestone
08190500	1799	64	428	5.4	1.00	329	0.42	Carbonate	limestone
08194200	1221	60	96	0.8	0.72	193	0.58	Unconsol. sed.	sand

STAID	DA (km^2)	Precip. (mm/y)	Elev. (mASL)	Mean watershed slope (%)	Ptrend (mm/y/y)	Basin relief (m)	Drainage density (km/km^2)	Lithology (group)	Lithology (specific)
08195000	1028	76	372	11.9	0.62	370	0.68	Carbonate	limestone
08196000	327	77	414	10.4	0.62	310	0.86	Carbonate	limestone
08200000	249	81	363	11.2	0.32	324	0.58	Carbonate	limestone
08201500	117	84	395	14.3	0.32	299	0.63	Carbonate	limestone
08202700	435	74	283	7.7	0.32	414	0.63	Carbonate	limestone
08210400	402	74	63	1.8	0.39	160	0.30	Unconsol. sed.	terrace
08253500	7	62	2898	30.3	1.27	1048	0.62	Plutonics	plutonic rock (phaneritic)
08267500	96	46	2400	44.4	1.72	1661	0.48	Plutonics	plutonic rock (phaneritic)
08269000	163	42	2271	31.2	1.72	1730	0.56	Clastic sedim.	medium-grained mixed clastic
08271000	44	48	2460	44.1	1.72	1528	0.48	Clastic sedim.	medium-grained mixed clastic
08277470	258	52	2384	25.8	0.53	1530	0.53	Clastic sedim.	medium-grained mixed clastic
08315480	35	60	2447	36.5	1.19	1360	0.49	Plutonics	plutonic rock (phaneritic)
08324000	1208	28	1726	18.3	0.96	1707	0.84	Unconsol. sed.	alluvium
08340500	3547	24	1812	5.7	1.35	1460	0.55	Clastic sedim.	shale
08377900	139	62	2423	24.8	1.19	1231	0.50	Clastic sedim.	medium-grained mixed clastic
08378500	445	57	2288	26.5	1.19	1686	0.56	Clastic sedim.	medium-grained mixed clastic
08380500	198	51	2136	25.0	1.31	1452	0.66	Clastic sedim.	medium-grained mixed clastic
08386505	49	65	2192	32.5	0.93	1474	0.66	Volcanics	felsic volcanic rock
09034900	16	71	3185	42.6	-0.16	936	0.30	Plutonics	granite
09035900	73	56	2732	35.7	-0.16	1265	0.62	Plutonics	felsic gneiss
09047700	24	54	2852	30.2	0.22	929	0.34	Plutonics	felsic gneiss
09063400	62	60	2720	29.8	-0.37	976	0.54	Clastic sedim.	sandstone
09066000	32	67	2802	27.5	-0.56	1070	0.65	Clastic sedim.	sandstone
09066100	12	61	2667	48.1	-0.56	1324	0.59	Plutonics	granite
09066150	14	63	2599	47.3	-0.56	1356	0.69	Plutonics	granite
09066200	16	63	2547	43.2	-0.56	1411	0.86	Plutonics	granite
09066300	16	58	2507	31.0	-0.56	1262	0.50	Clastic sedim.	sandstone
09066400	19	63	2869	23.6	-0.56	954	0.88	Clastic sedim.	sandstone
09081600	433	49	2109	41.1	-0.06	2170	0.49	Clastic sedim.	mudstone
09107000	332	51	2854	23.2	0.58	1265	0.72	Plutonics	granitoid
09196500	195	56	2291	31.3	-0.15	1888	0.62	Plutonics	granitoid
09210500	398	33	2121	18.9	0.03	965	0.82	Clastic sedim.	shale
09223000	333	50	2275	18.0	0.07	752	0.80	Clastic sedim.	shale
09306242	82	41	2007	16.6	0.52	627	0.82	Clastic sedim.	sandstone
09312600	195	45	2214	20.9	0.20	807	0.54	Clastic sedim.	shale
09329050	63	59	2742	18.5	0.32	800	0.36	Volcanics	ash-flow tuff
09352900	188	76	2422	47.1	0.71	1860	0.58	Plutonics	granite
09378170	22	46	2195	21.4	0.91	1268	0.74	Clastic sedim.	shale
09378630	10	52	2209	27.1	0.91	1145	0.80	Clastic sedim.	shale
09386900	185	37	2112	6.5	0.72	548	0.71	Clastic sedim.	medium-grained mixed clastic
09404115	7782	20	615	5.5	0.49	2582	0.69	Carbonate	limestone
09404208	779	22	426	20.1	0.32	1824	0.90	Clastic sedim.	sandstone
09404222	665	22	502	17.0	0.32	1529	0.90	Clastic sedim.	sandstone
09404343	909	29	1155	7.6	0.26	868	0.83	Clastic sedim.	sandstone
09404450	193	41	1800	23.3	0.37	792	0.49	Clastic sedim.	sandstone
09408195	3473	22	853	6.7	0.59	1589	0.79	Carbonate	limestone
09415515	27	28	1957	31.3	0.64	1065	0.59	Carbonate	limestone
09423350	2	30	1768	30.0	1.00	529	0.99	Plutonics	granodiorite
09444200	1308	37	1279	24.7	1.06	1598	0.97	Volcanics	dacite
09447800	782	34	1056	15.9	0.66	1190	1.32	Volcanics	dacite
09470800	22	57	1628	35.7	-0.25	997	0.73	Clastic sedim.	conglomerate
09480000	213	46	1417	6.1	-0.28	551	0.90	Clastic sedim.	conglomerate
09484000	104	39	872	35.6	0.28	1953	0.80	Plutonics	granodiorite
09484600	1180	41	979	9.8	0.28	1824	0.78	Clastic sedim.	conglomerate
09487000	2028	30	773	7.7	0.08	1559	0.89	Unconsol. sed.	sand
09492400	129	59	1830	21.9	0.72	1641	0.77	Volcanics	rhyolite
09494000	1628	49	1365	14.3	0.72	2144	0.84	Volcanics	rhyolite
09497800	751	47	991	19.4	0.59	1319	0.83	Clastic sedim.	sandstone
09497980	517	49	985	19.9	0.59	1372	0.70	Clastic sedim.	sandstone
09505200	286	51	1226	10.7	0.38	1356	0.68	Volcanics	basalt
09505350	366	44	1129	12.8	0.38	1243	0.76	Volcanics	basalt
09505800	615	49	1111	10.6	0.38	1776	0.78	Carbonate	limestone
09508300	93	45	712	27.8	0.30	1560	0.70	Plutonics	granodiorite
09510200	425	39	545	21.4	0.50	1620	1.04	Plutonics	granodiorite
09513780	177	39	721	22.5	0.30	1078	0.87	Volcanics	dacite
09535100	1483	23	558	3.9	0.23	694	0.86	Unconsol. sed.	sand
09537200	204	38	1412	13.1	0.40	769	0.78	Volcanics	dacite
10172200	19	70	1664	38.4	-0.14	847	0.46	Carbonate	limestone
10172700	70	49	1916	15.3	0.41	658	0.72	Unconsol. sed.	alluvium
10172800	11	70	1960	48.8	0.15	1419	0.52	Clastic sedim.	arenite
10173450	269	45	2223	10.7	0.61	1224	0.42	Volcanics	volcanic rock (aphanitic)
10205030	135	49	2142	19.9	0.32	1235	0.49	Unconsol. sed.	fine-grained mixed clastic
10242000	209	35	1828	27.1	0.61	1457	0.67	Clastic sedim.	sandstone
10243260	28	33	2047	32.5	0.66	1906	0.70	Unconsol. sed.	glacial drift
10244950	28	40	2252	30.4	0.50	1079	0.97	Carbonate	limestone
10249300	50	27	1923	43.7	0.89	1572	0.70	Volcanics	rhyolite
10257600	93	29	731	38.3	0.95	2188	0.91	Unconsol. sed.	alluvium
10258000	44	21	264	37.1	0.95	3034	0.87	Plutonics	tonalite
10258500	242	18	208	22.7	0.95	2244	0.98	Plutonics	tonalite
10259000	22	20	259	46.0	0.95	2301	1.01	Plutonics	tonalite
10259200	79	23	461	24.9	0.97	2233	1.03	Plutonics	tonalite
10263500	59	32	1245	44.5	0.86	1624	0.89	Plutonics	granodiorite

STAID	DA (km^2)	Precip. (mm/y)	Elev. (mASL)	Mean watershed slope (%)	Ptrend (mm/y/y)	Basin relief (m)	Drainage density (km/km^2)	Lithology (group)	Lithology (specific)
10291500	114	44	2111	36.9	0.72	1502	0.69	Plutonics	granodiorite
10308200	716	57	1645	29.6	0.80	1822	0.84	Plutonics	granodiorite
10308783	11	64	2164	18.4	0.80	446	0.38	Volcanics	andesite
10310500	39	38	1515	26.6	0.27	1286	0.63	Plutonics	granodiorite
10313400	184	28	1812	27.7	0.15	1401	0.74	Volcanics	rhyolite
10316500	65	47	1916	51.9	-0.15	1525	0.52	Metamorphics	marble
10321590	477	23	1498	12.2	0.20	1076	1.10	Clastic sedim.	shale
10329500	455	39	1447	16.6	0.04	1494	1.06	Volcanics	rhyolite
10336645	20	85	1903	19.3	-0.68	755	0.88	Plutonics	granodiorite
10336660	30	87	1921	28.4	-0.68	776	0.71	Unconsol. sed.	glacial drift
10336674	13	147	2023	29.2	-0.68	628	0.42	Unconsol. sed.	glacial drift
10336676	25	87	1908	24.6	-0.68	746	0.55	Unconsol. sed.	glacial drift
10336740	6	60	2045	19.6	0.27	675	0.78	Plutonics	granodiorite
10336770	19	85	2121	31.1	-0.68	1097	0.64	Plutonics	granodiorite
10343500	28	88	1936	14.2	-0.60	707	0.80	Volcanics	andesite
10353750	34	29	1901	21.5	-0.02	798	0.73	Volcanics	rhyolite
10396000	529	34	1298	13.7	0.43	1665	0.81	Volcanics	basalt
11015000	118	64	1002	17.6	1.11	941	0.71	Plutonics	tonalite
11046300	210	45	190	21.5	0.32	954	0.86	Plutonics	tonalite
11098000	42	62	444	42.8	0.89	1439	1.13	Plutonics	quartz monzonite
11124500	192	60	256	33.5	0.69	1755	1.17	Clastic sedim.	sandstone
11138500	729	49	193	34.2	0.69	1888	1.16	Clastic sedim.	sandstone
11143000	121	63	80	43.6	n/a	1429	0.98	Plutonics	plutonic rock (phaneritic)
11148900	403	46	256	21.3	1.19	884	0.99	Clastic sedim.	sandstone
11151870	285	55	292	39.0	0.39	1546	0.97	Clastic sedim.	sandstone
11153470	25	74	207	29.6	1.00	885	0.83	Clastic sedim.	sandstone
11154700	37	54	799	21.2	0.96	797	1.16	Metamorphics	serpentinite
11162500	119	77	30	26.7	0.38	789	1.01	Clastic sedim.	sandstone
11162570	132	69	11	22.3	0.38	771	0.90	Clastic sedim.	sandstone
11169800	283	63	244	25.6	1.00	859	0.99	Clastic sedim.	sandstone
11172945	87	66	297	26.7	1.00	864	1.07	Clastic sedim.	sandstone
11173200	199	65	248	26.7	1.00	1061	0.96	Clastic sedim.	sandstone
11180500	24	50	27	19.4	1.00	495	1.00	Unconsol. sed.	alluvium
11180960	15	62	118	23.3	1.00	500	0.92	Clastic sedim.	sandstone
11203580	52	82	1137	34.8	1.41	1693	0.80	Plutonics	granodiorite
11230500	136	75	2262	35.0	0.91	1913	0.62	Plutonics	granodiorite
11253310	120	21	223	24.3	0.55	1335	1.24	Unconsol. sed.	alluvium
11264500	468	97	1227	30.0	0.72	2743	0.77	Plutonics	granodiorite
11274630	187	29	65	26.1	0.38	1054	1.08	Clastic sedim.	sandstone
11284400	42	93	782	13.6	-0.44	424	1.02	Clastic sedim.	argillite
11299600	37	61	231	14.1	0.35	479	1.24	Metamorphics	mafic volcanic rock
11364300	80	166	1091	15.7	-2.86	981	0.63	Volcanics	andesite
11381500	338	69	128	27.0	-0.17	3044	0.61	Volcanics	andesite
11383500	540	88	161	23.0	-0.17	2235	0.62	Volcanics	andesite
11413323	5	184	963	15.1	-3.82	268	0.95	Plutonics	granodiorite
11427700	26	175	1607	25.3	-0.60	654	0.77	Clastic sedim.	argillite
11431800	30	146	1312	16.0	-0.68	574	1.04	Clastic sedim.	argillite
11449500	95	105	460	20.0	0.65	979	0.70	Clastic sedim.	sandstone
11468500	274	117	28	28.3	-1.38	959	0.75	Clastic sedim.	sandstone
11473900	1925	132	296	26.4	-0.49	2029	0.88	Clastic sedim.	sandstone
11475560	17	208	433	34.2	-0.49	864	0.80	Clastic sedim.	sandstone
11478500	572	141	120	25.8	-0.98	1676	0.86	Clastic sedim.	sandstone
11481200	105	135	38	19.8	-2.47	1020	0.72	Metamorphics	blueschist
11481500	175	153	275	27.7	-0.98	1355	0.85	Clastic sedim.	sandstone
12010000	142	284	15	24.7	-4.64	782	0.87	Volcanics	tholeiite
12020800	70	143	110	21.0	-2.49	694	0.69	Volcanics	tholeiite
12025000	405	115	61	12.8	-2.49	1103	0.63	Volcanics	andesite
12025700	103	122	230	27.7	-1.74	944	0.73	Volcanics	andesite
12035000	770	189	12	16.1	-2.99	1174	0.74	Volcanics	tholeiite
12040500	1153	275	0	30.6	-4.66	2211	0.64	Clastic sedim.	graywacke
12041200	656	304	56	40.8	-3.38	2334	0.60	Clastic sedim.	graywacke
12043000	337	290	61	35.5	-3.38	1083	0.64	Clastic sedim.	sandstone
12043300	135	234	17	24.5	-3.38	795	0.78	Clastic sedim.	siltstone
12048000	405	76	174	46.2	-2.04	2149	0.56	Clastic sedim.	sandstone
12054000	172	160	124	54.2	-0.09	1997	0.53	Clastic sedim.	sandstone
12056500	147	259	239	53.1	-5.49	1671	0.54	Clastic sedim.	sandstone
12060500	198	227	58	42.5	-2.99	1439	0.74	Clastic sedim.	sandstone
12073500	16	135	28	3.7	-1.27	133	0.36	Unconsol. sed.	till
12079000	224	123	127	21.1	-1.74	1065	0.75	Volcanics	andesite
12082500	350	194	441	33.9	-2.70	3936	0.80	Volcanics	basalt
12094000	205	162	388	41.0	-2.70	3885	0.77	Volcanics	basalt
12095000	206	119	129	23.0	-2.70	1659	0.74	Volcanics	andesite
12096500	1143	102	21	25.3	-0.84	4373	0.67	Volcanics	basalt
12097500	190	138	536	35.7	-2.70	1491	0.69	Volcanics	andesite
12097850	970	173	361	38.2	-2.70	4035	0.75	Volcanics	basalt
12108500	71	115	68	6.3	-0.84	868	0.52	Volcanics	andesite
12114500	67	259	578	37.1	-1.31	1076	0.81	Volcanics	andesite
12115700	13	244	486	35.2	-0.84	836	0.63	Volcanics	andesite
12117000	45	183	354	24.3	-0.84	954	0.78	Volcanics	andesite
12137290	30	360	454	53.3	-2.49	1122	0.48	Clastic sedim.	argillite
12141300	402	213	238	50.2	-1.31	2043	0.70	Clastic sedim.	arkose
12142000	166	208	365	44.4	-1.31	1440	0.67	Plutonics	granodiorite

STAID	DA (km^2)	Precip. (mm/y)	Elev. (mASL)	Mean watershed slope (%)	Ptrend (mm/y/y)	Basin relief (m)	Drainage density (km/km^2)	Lithology (group)	Lithology (specific)
12147500	103	171	237	34.7	-0.84	1595	0.70	Plutonics	granodiorite
12167000	684	142	35	32.6	-0.74	2049	0.59	Unconsol. sed.	outwash
12175500	274	191	395	58.8	-1.15	2381	0.57	Plutonics	quartz monzodiorite
12179900	128	199	133	57.2	-2.49	2061	0.54	Plutonics	granodiorite
12186000	398	250	284	52.8	-2.49	2081	0.63	Plutonics	biotite gneiss
12189500	1855	222	83	47.3	-2.49	3127	0.58	Plutonics	biotite gneiss
12201500	224	103	13	17.6	-0.74	1286	0.73	Unconsol. sed.	alluvium
12209000	268	186	120	35.1	-2.49	1815	0.64	Metamorphics	phyllite
12210700	1525	120	46	36.2	-1.19	3237	0.69	Clastic sedim.	arkose
12354000	828	52	809	34.4	-2.18	1417	0.68	Metamorphics	mica schist
12358500	2939	71	957	40.4	-1.38	2114	0.72	Metamorphics	quartzite
12359800	3000	69	1110	36.7	-0.17	1730	0.71	Metamorphics	quartzite
12375900	20	45	1024	51.4	-0.17	1596	0.67	Carbonate	carbonate
12377150	32	59	1062	57.6	-0.11	1778	0.75	Carbonate	carbonate
12381400	151	89	1218	28.5	-0.11	1258	0.62	Metamorphics	quartzite
12387450	42	48	1057	31.5	-0.25	1338	0.75	Metamorphics	meta-argillite
12388400	61	60	1046	28.1	-0.25	1263	0.51	Metamorphics	meta-argillite
12390700	470	59	743	37.9	-2.18	1305	0.52	Metamorphics	meta-argillite
12411000	867	100	762	33.1	-2.00	1083	0.86	Metamorphics	quartzite
12413875	275	114	1138	34.8	-2.41	1186	0.68	Metamorphics	quartzite
12414500	2679	76	667	35.1	-1.81	1652	0.70	Metamorphics	schist
12433542	16	47	664	12.2	0.37	529	0.18	Plutonics	granite
12447383	951	54	622	48.2	-0.66	2071	0.76	Plutonics	granodiorite
12447390	58	73	1323	35.3	-0.66	1330	0.75	Plutonics	granite
12451000	831	90	355	55.8	-1.83	2499	0.67	Plutonics	quartz monzodiorite
12452800	526	42	480	42.3	-0.31	2273	0.70	Plutonics	granite
12452890	236	36	389	32.3	-0.31	1736	0.82	Plutonics	granite
12456500	446	82	639	41.1	-0.31	2114	0.76	Plutonics	granodiorite
12458000	499	93	484	47.9	-0.31	2330	0.67	Plutonics	granite
12488500	205	99	861	39.2	-0.72	1254	0.77	Volcanics	andesite
13010065	1222	83	2076	13.7	-0.67	1054	0.49	Volcanics	rhyolite
13011900	852	70	2078	24.0	-0.67	1380	0.65	Unconsol. sed.	mixed clastic/volcanic
13018300	28	70	2070	33.2	-0.31	1077	0.28	Unconsol. sed.	alluvium
13023000	1162	65	1757	30.4	-0.11	1708	0.57	Clastic sedim.	siltstone
13046995	835	70	1769	8.8	0.49	926	0.63	Volcanics	rhyolite
13083000	133	34	1477	22.9	0.08	925	0.86	Volcanics	rhyolite
13161500	986	34	1542	20.2	0.06	1495	0.86	Volcanics	rhyolite
13162225	76	59	1852	40.6	0.06	1436	0.69	Volcanics	rhyolite
13235000	1163	67	1155	39.9	-1.41	2077	0.75	Plutonics	granodiorite
13237920	875	63	924	29.1	-1.50	1665	0.83	Plutonics	quartz monzodiorite
13240000	126	92	1564	38.0	-1.30	1138	0.75	Plutonics	granodiorite
13296500	2091	54	1828	28.8	-0.97	1507	0.87	Plutonics	granodiorite
13310199	7451	46	924	39.5	-0.44	2238	0.77	Plutonics	granodiorite
13310700	853	57	1146	32.1	-1.30	1635	0.86	Plutonics	quartz monzodiorite
13313000	562	68	1439	25.0	-0.64	1358	0.76	Plutonics	granodiorite
13331500	619	54	795	37.7	0.79	2005	0.63	Volcanics	basalt
13337000	3053	87	449	33.2	-0.75	2226	0.72	Plutonics	granodiorite
13338500	3027	62	404	21.1	-0.90	2303	0.88	Volcanics	basalt
13339500	625	60	368	17.3	-0.85	1496	0.89	Plutonics	granodiorite
13340000	14269	63	308	29.2	-0.85	2513	0.81	Plutonics	granodiorite
13340600	3355	95	512	33.9	-1.71	1884	0.72	Plutonics	granodiorite
14020000	341	74	578	32.2	0.19	1105	0.65	Volcanics	basalt
14020300	456	76	555	28.4	0.19	1219	0.79	Volcanics	basalt
14036860	104	56	1286	32.9	0.46	1300	0.52	Volcanics	basalt
14090350	72	52	854	26.1	-0.64	2248	0.78	Volcanics	basalt
14092750	57	97	1096	24.7	-1.25	1000	0.84	Volcanics	basalt
14096300	68	98	1035	19.1	-1.25	1156	0.67	Volcanics	basalt
14096850	375	39	688	10.6	-0.13	1011	0.75	Volcanics	basalt
14107000	394	80	830	22.6	-3.26	1648	0.84	Volcanics	tholeiite
14138800	21	289	781	25.9	-2.19	566	0.86	Volcanics	basalt
14138870	14	246	463	27.1	-2.19	837	0.67	Volcanics	basalt
14139800	41	216	298	21.9	-2.19	997	0.81	Volcanics	basalt
14150800	113	123	275	26.5	-2.47	1247	0.62	Volcanics	basalt
14154500	547	124	291	33.3	-2.78	1527	0.68	Volcanics	basalt
14158500	237	204	948	16.7	-2.11	1144	0.46	Volcanics	basalt
14158790	41	224	869	31.2	-2.11	934	0.54	Volcanics	basalt
14159200	414	183	534	28.7	-2.11	1521	0.70	Volcanics	basalt
14161500	62	222	435	33.3	-2.11	1183	0.55	Volcanics	basalt
14166500	227	152	129	19.1	-2.10	510	0.58	Clastic sedim.	sandstone
14179000	273	223	525	34.9	-2.80	1644	0.85	Volcanics	basalt
14180300	67	190	559	26.5	-2.80	1186	0.62	Volcanics	basalt
14182500	287	182	209	35.9	-2.80	1453	0.68	Volcanics	basalt
14185900	258	209	343	37.8	-2.80	1174	0.68	Volcanics	basalt
14187000	135	153	242	28.6	-2.11	1127	0.63	Volcanics	basalt
14198400	2	205	525	36.1	-2.80	703	0.65	Volcanics	basalt
14216500	350	289	332	30.0	-8.09	2145	0.82	Volcanics	basalt
14231000	1378	159	268	38.3	-3.26	4123	0.82	Volcanics	basalt
14236200	361	186	187	33.1	-1.74	1251	0.58	Volcanics	andesite
14301000	1744	313	13	19.5	-3.08	1081	0.70	Volcanics	basalt
14305500	526	198	35	26.3	-0.80	1047	0.97	Clastic sedim.	siltstone
14306340	15	196	222	36.6	-1.99	827	0.43	Clastic sedim.	sandstone
14306500	857	207	18	27.4	-1.99	1227	0.67	Clastic sedim.	sandstone

STAID	DA (km^2)	Precip. (mm/y)	Elev. (mASL)	Mean watershed slope (%)	Ptrend (mm/y/y)	Basin relief (m)	Drainage density (km/km^2)	Lithology (group)	Lithology (specific)
14307620	1529	208	7	26.6	-2.10	1020	0.73	Clastic sedim.	sandstone
14308990	168	108	587	26.5	-1.19	940	0.75	Volcanics	basalt
14309500	225	115	313	33.0	-1.53	998	0.66	Clastic sedim.	graywacke
14316495	79	118	526	37.4	-1.61	1357	0.75	Volcanics	basalt
14316700	588	124	352	34.4	-2.78	1469	0.69	Volcanics	basalt
14318000	459	125	276	27.1	-1.19	1345	0.71	Volcanics	basalt
14325000	443	152	74	28.4	-1.53	1173	0.65	Clastic sedim.	siltstone
14362250	41	66	531	37.5	-0.46	1004	0.76	Volcanics	andesite
14400000	703	217	17	36.5	-2.24	1518	0.61	Clastic sedim.	mudstone
103366993	9	79	2110	22.9	0.03	687	0.51	Plutonics	granodiorite
103367592	2	68	1972	32.4	0.27	930	1.06	Plutonics	granodiorite
0204382800	161	123	0	0.0	0.91	6	0.70	Unconsol. sed.	lake or marine deposit
0208111310	288	123	3	0.2	-0.86	28	0.57	Unconsol. sed.	clay or mud

STAID	BE N msts	BE years	BE p	BE type	BET (cm/y)	BEV (m)	Q_{50}trend p	Q_{50}trend ($m^3/s/y$)	Q_{90}trend p	Q_{90}trend ($m^3/s/y$)	Q_{90}&Q_{50} years	Q_{90}/Q_{50}	Q_{90}/Q_{50} years	Q_{50} (m^3/s)	Q_{90} (m^3/s)
01021480	92	10.1	> 0.05	BEV	no trend	0.13	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
01022260	56	28.3	> 0.05	BEV	no trend	0.16	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
01022500	95	19.7	1.12E-07	BET-	-1.95	n/a	> 0.05	n/a	> 0.05	n/a	61	3.7	61	7.9	32.2
01029200	84	12.1	> 0.05	BEV	no trend	0.14	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
01031300	73	14.4	> 0.05	BEV	no trend	0.25	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
01031500	92	17.7	1.04E-04	BET-	-2.95	n/a	> 0.05	n/a	> 0.05	n/a	61	5.8	61	7.4	42.6
01037380	106	11.7	1.09E-02	BET+	0.85	n/a	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
01047000	88	31.3	> 0.05	BEV	no trend	0.14	> 0.05	n/a	> 0.05	n/a	61	5.1	61	9.5	51.9
01052500	95	26.9	2.26E-06	BET+	1.63	n/a	> 0.05	n/a	> 0.05	n/a	61	5.1	61	4.5	23.8
01054200	127	26.9	6.09E-06	BET-	-0.83	n/a	> 0.05	n/a	> 0.05	n/a	46	5.1	46	2.3	12.1
01055000	107	33.4	2.17E-04	BET-	-1.21	n/a	> 0.05	n/a	> 0.05	n/a	61	5.4	61	2.5	14.4
01057000	117	25.9	1.85E-06	BET-	-2.17	n/a	> 0.05	n/a	> 0.05	n/a	61	4.9	61	1.9	9.1
01064801	138	18.3	6.29E-03	BET+	0.44	n/a	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
01075800	88	11.0	> 0.05	BEV	no trend	0.08	> 0.05	n/a	> 0.05	n/a	33	6.9	33	0.0	0.3
01078000	147	60.1	> 0.05	BEV	no trend	0.20	> 0.05	n/a	> 0.05	n/a	60	4.6	60	2.1	10.1
01086000	65	56.0	> 0.05	BEV	no trend	0.17	2.82E-02	4.19E-02	> 0.05	n/a	61	4.5	61	3.8	17.6
01091000	23	58.9	4.46E-04	BET+	1.11	n/a	> 0.05	n/a	> 0.05	n/a	61	4.3	61	2.7	12.4
01115630	66	17.5	> 0.05	BEV	no trend	0.20	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
01115670	47	15.4	2.13E-07	BET-	-8.92	n/a	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
01115770	54	15.8	8.07E-06	BET-	-3.70	n/a	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
01117370	116	22.0	7.92E-03	BET+	0.23	n/a	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
01117468	185	30.5	1.29E-07	BET-	-0.05	n/a	> 0.05	n/a	> 0.05	n/a	36	2.4	36	0.5	1.2
01118300	404	50.0	> 0.05	BEV	no trend	0.07	> 0.05	n/a	1.02E-02	2.66E-03	52	3.1	52	0.2	0.5
01121000	523	54.7	1.53E-30	BET-	-0.24	n/a	> 0.05	n/a	> 0.05	n/a	61	3.3	61	1.0	3.2
01123000	210	56.7	> 0.05	BEV	no trend	0.09	> 0.05	n/a	> 0.05	n/a	59	3.2	59	1.1	3.1
01130000	130	23.5	> 0.05	BEV	no trend	0.13	4.95E-02	2.48E-02	> 0.05	n/a	60	4.4	60	6.9	31.3
01134500	125	23.7	> 0.05	BEV	no trend	0.46	5.34E-06	1.82E-02	> 0.05	n/a	61	4.6	61	2.1	9.7
01135150	106	20.6	> 0.05	BEV	no trend	0.06	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
01135300	115	20.5	2.17E-02	BET+	0.09	n/a	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
01137500	161	23.5	> 0.05	BEV	no trend	0.10	1.07E-03	2.23E-02	> 0.05	n/a	61	4.0	61	2.9	13.2
01139000	132	22.4	> 0.05	BEV	no trend	0.18	3.27E-05	2.79E-02	> 0.05	n/a	61	3.7	61	2.3	9.5
01142500	160	24.0	1.08E-09	BET+	0.62	n/a	7.20E-05	9.64E-03	3.57E-03	1.77E-02	60	3.6	60	0.8	3.1
01144000	134	60.2	3.42E-02	BET+	0.36	n/a	1.77E-04	1.99E-01	> 0.05	n/a	60	3.8	60	18.8	75.9
01150900	181	22.7	> 0.05	BEV	no trend	0.07	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
01162500	157	27.0	> 0.05	BEV	no trend	0.07	1.44E-02	3.96E-03	> 0.05	n/a	61	4.1	61	0.5	2.4
01169000	178	25.9	> 0.05	BEV	no trend	0.17	6.79E-03	1.92E-02	> 0.05	n/a	60	4.2	60	2.8	12.2
01170100	177	26.4	8.48E-06	BET-	-0.84	n/a	> 0.05	n/a	> 0.05	n/a	41	3.7	41	1.4	5.7
01174565	121	26.7	5.38E-05	BET-	-0.52	n/a	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
01188000	168	38.3	> 0.05	BEV	no trend	0.11	> 0.05	n/a	> 0.05	n/a	61	3.2	61	0.2	0.5
01195100	166	29.8	1.80E-09	BET+	0.80	n/a	> 0.05	n/a	> 0.05	n/a	29	3.5	29	0.2	0.6
01198000	72	16.5	> 0.05	BEV	no trend	0.16	> 0.05	n/a	> 0.05	n/a	59	3.7	59	1.4	5.0
01208950	167	37.5	> 0.05	BEV	no trend	0.04	> 0.05	n/a	> 0.05	n/a	46	3.4	46	0.2	0.8
01208990	141	33.1	1.55E-02	BET-	-0.04	n/a	> 0.05	n/a	> 0.05	n/a	44	3.1	44	0.8	2.5
01333000	197	60.4	3.79E-02	BET+	0.12	n/a	1.96E-02	8.91E-03	> 0.05	n/a	61	3.5	61	1.5	5.4
01333500	142	26.9	2.37E-02	BET-	-0.16	n/a	> 0.05	n/a	> 0.05	n/a	43	4.0	43	1.4	6.2
01343060	73	10.6	2.10E-05	BET-	-3.08	n/a	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
01349711	86	14.0	3.25E-03	BET+	0.57	n/a	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
01349810	83	13.6	4.51E-08	BET-	-1.76	n/a	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
01349840	85	11.6	1.03E-05	BET-	-1.05	n/a	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
01350080	199	23.7	2.01E-08	BET-	-1.05	n/a	2.45E-02	1.92E-02	> 0.05	n/a	24	4.0	24	0.8	3.3
01350140	311	40.8	1.56E-27	BET+	0.91	n/a	> 0.05	n/a	> 0.05	n/a	35	4.1	35	0.4	1.6
01362200	180	22.8	9.58E-16	BET-	-1.28	n/a	1.97E-03	2.81E-02	6.26E-03	7.97E-02	47	3.5	47	2.2	8.9
01362497	95	11.3	> 0.05	BEV	no trend	0.15	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
01364959	147	26.9	1.79E-02	BET-	-0.25	n/a	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
01409810	207	36.6	2.61E-13	BET-	-0.49	n/a	> 0.05	n/a	> 0.05	n/a	36	2.4	36	2.8	7.4
01413408	90	14.6	1.38E-02	BET+	1.04	n/a	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
01413500	603	61.7	5.43E-16	BET+	0.19	n/a	4.23E-02	2.70E-02	> 0.05	n/a	61	3.6	61	5.2	19.5
01414500	621	61.5	> 0.05	BEV	no trend	0.13	4.25E-02	4.49E-03	> 0.05	n/a	61	3.4	61	0.9	3.3
01415000	600	61.5	4.44E-15	BET+	0.20	n/a	> 0.05	n/a	> 0.05	n/a	61	3.7	61	1.0	3.8
01421618	94	14.3	6.13E-04	BET-	-1.34	n/a	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
01422389	87	11.1	> 0.05	BEV	no trend	0.08	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
01422738	70	10.0	3.81E-05	BET+	0.86	n/a	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
01422747	87	12.7	1.39E-05	BET+	1.81	n/a	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
01423000	548	58.1	1.35E-03	BET+	0.20	n/a	2.75E-02	6.58E-02	> 0.05	n/a	60	4.0	60	9.6	37.5
01434017	145	19.9	1.34E-03	BET-	-0.26	n/a	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
01434021	168	18.9	6.24E-15	BET+	0.49	n/a	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.

STAID	BE N msts	BE years	BE p	BE type	BET (cm/y)	BEV (m)	Q_{50}trend p	Q_{50}trend ($m^3/s/y$)	Q_{90}trend p	Q_{90}trend ($m^3/s/y$)	Q_{90}&Q_{50} years	Q_{90}/Q_{50}	Q_{90}/Q_{50} years	Q_{50} (m^3/s)	Q_{90} (m^3/s)
01440000	269	52.9	5.80E-11	BET+	0.18	n/a	> 0.05	n/a	> 0.05	n/a	61	3.1	61	2.1	6.3
01440400	462	54.2	3.38E-07	BET-	-0.11	n/a	1.27E-02	1.84E-02	> 0.05	n/a	53	3.1	53	2.4	8.3
01460880	54	33.5	1.32E-09	BET-	-2.88	n/a	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
01461300	55	50.2	1.91E-09	BET-	-1.85	n/a	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
01466500	411	50.9	4.83E-10	BET-	-0.10	n/a	1.63E-02	-3.08E-04	> 0.05	n/a	57	1.6	57	0.1	0.1
01471875	126	14.7	> 0.05	BEV	no trend	0.09	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
01484100	529	51.5	2.05E-47	BET+	0.31	n/a	> 0.05	n/a	> 0.05	n/a	52	2.1	52	0.1	0.2
01485000	630	61.7	1.32E-39	BET+	0.70	n/a	> 0.05	n/a	> 0.05	n/a	61	3.7	61	1.0	4.1
01485500	620	61.7	> 0.05	BEV	no trend	0.15	> 0.05	n/a	> 0.05	n/a	61	4.2	61	0.7	3.3
01490000	363	57.3	1.77E-13	BET-	-0.23	n/a	> 0.05	n/a	> 0.05	n/a	58	2.7	58	0.3	0.9
01491000	768	62.0	9.56E-26	BET+	0.38	n/a	> 0.05	n/a	> 0.05	n/a	61	3.6	61	2.1	6.9
01492000	267	59.2	2.15E-07	BET+	0.20	n/a	> 0.05	n/a	> 0.05	n/a	59	5.0	59	0.1	0.3
01493500	624	60.5	> 0.05	BEV	no trend	0.12	6.43E-03	1.08E-03	> 0.05	n/a	59	2.4	59	0.2	0.4
01502500	176	26.2	> 0.05	BEV	no trend	0.10	1.08E-02	1.17E-01	> 0.05	n/a	61	3.9	61	13.6	56.9
01510000	261	27.5	2.20E-15	BET-	-0.82	n/a	2.90E-02	3.12E-02	> 0.05	n/a	61	4.1	61	4.0	17.3
01516500	540	57.7	6.42E-04	BET+	0.12	n/a	1.90E-02	1.54E-03	> 0.05	n/a	56	6.5	56	0.1	0.8
01518862	224	25.0	2.79E-24	BET-	-1.17	n/a	> 0.05	n/a	> 0.05	n/a	27	5.9	27	1.3	6.7
01525981	113	22.3	1.71E-05	BET-	-0.29	n/a	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
01527500	92	15.1	> 0.05	BEV	no trend	0.12	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
01539000	502	61.3	1.74E-10	BET-	-0.24	n/a	> 0.05	n/a	> 0.05	n/a	61	3.6	61	8.0	30.5
01542810	375	46.2	4.88E-03	BET-	-0.02	n/a	> 0.05	n/a	> 0.05	n/a	46	5.5	46	0.1	0.6
01543500	435	60.1	2.11E-02	BET+	0.04	n/a	> 0.05	n/a	> 0.05	n/a	61	4.7	61	17.3	77.2
01544500	511	58.6	5.48E-16	BET-	-0.30	n/a	> 0.05	n/a	> 0.05	n/a	61	4.9	61	3.1	14.8
01545600	393	43.7	5.02E-09	BET-	-0.14	n/a	> 0.05	n/a	> 0.05	n/a	46	4.1	46	1.1	4.5
01548500	422	59.2	1.13E-20	BET-	-0.35	n/a	> 0.05	n/a	> 0.05	n/a	61	4.8	61	12.0	56.6
01549500	581	61.8	2.15E-23	BET-	-0.26	n/a	> 0.05	n/a	> 0.05	n/a	61	4.9	61	0.8	3.6
01550000	544	61.4	6.34E-23	BET+	0.33	n/a	> 0.05	n/a	> 0.05	n/a	61	4.3	61	4.5	18.4
01552500	539	61.1	8.63E-48	BET-	-0.33	n/a	> 0.05	n/a	> 0.05	n/a	61	3.6	61	0.7	2.9
01557500	365	58.7	> 0.05	BEV	no trend	0.20	> 0.05	n/a	> 0.05	n/a	61	3.9	61	1.2	4.7
01564500	352	59.1	> 0.05	BEV	no trend	0.22	> 0.05	n/a	> 0.05	n/a	61	5.6	61	2.6	16.0
01566000	119	55.3	2.18E-02	BET-	-0.52	n/a	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
01567500	353	44.9	1.41E-06	BET+	0.16	n/a	7.30E-03	2.99E-03	> 0.05	n/a	56	3.5	56	0.3	1.0
01568000	316	46.8	6.77E-04	BET-	-0.06	n/a	> 0.05	n/a	> 0.05	n/a	61	4.0	61	4.2	17.1
01580000	478	58.6	5.57E-03	BET-	-0.04	n/a	> 0.05	n/a	> 0.05	n/a	61	1.9	61	2.8	5.5
01581830	81	10.8	3.53E-02	BET-	-0.35	n/a	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
01583000	353	59.9	3.35E-15	BET+	0.46	n/a	> 0.05	n/a	> 0.05	n/a	60	1.9	60	0.0	0.1
01583500	614	61.4	3.17E-91	BET-	-0.43	n/a	> 0.05	n/a	> 0.05	n/a	61	2.0	61	1.5	2.8
01583580	124	44.0	7.21E-11	BET-	-0.19	n/a	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
01586610	244	26.3	1.85E-05	BET-	-0.42	n/a	> 0.05	n/a	> 0.05	n/a	27	2.3	27	0.6	1.6
01594950	209	21.8	> 0.05	BEV	no trend	0.10	> 0.05	n/a	> 0.05	n/a	23	4.3	23	0.1	0.3
01596500	577	61.7	5.88E-12	BET-	-0.11	n/a	> 0.05	n/a	> 0.05	n/a	61	5.4	61	0.9	5.0
01605500	390	58.5	1.00E-14	BET-	-0.19	n/a	> 0.05	n/a	> 0.05	n/a	61	4.0	61	2.4	9.7
01609000	191	45.2	> 0.05	BEV	no trend	0.20	> 0.05	n/a	> 0.05	n/a	43	4.8	43	2.0	11.5
01610155	235	44.4	2.05E-26	BET-	-0.47	n/a	> 0.05	n/a	> 0.05	n/a	43	6.4	43	0.8	6.3
01611500	168	58.4	9.28E-07	BET+	0.24	n/a	> 0.05	n/a	> 0.05	n/a	61	5.1	61	7.0	36.9
01613050	365	44.7	3.09E-32	BET+	0.38	n/a	> 0.05	n/a	> 0.05	n/a	45	6.1	45	0.1	0.8
01613900	179	28.5	5.59E-16	BET-	-0.42	n/a	> 0.05	n/a	> 0.05	n/a	50	5.8	50	0.1	0.8
01632000	459	60.6	1.02E-12	BET-	-0.23	n/a	> 0.05	n/a	> 0.05	n/a	61	6.4	61	1.8	11.3
01632900	169	29.7	3.65E-06	BET-	-0.35	n/a	> 0.05	n/a	> 0.05	n/a	50	3.1	50	1.2	3.6
01634500	151	20.6	4.89E-09	BET+	0.43	n/a	> 0.05	n/a	> 0.05	n/a	60	4.6	60	1.1	5.3
01636690	61	10.1	1.82E-03	BET-	-0.85	n/a	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
01639500	482	61.7	1.65E-02	BET+	0.03	n/a	> 0.05	n/a	> 0.05	n/a	61	3.0	61	1.8	5.5
01641500	317	34.8	2.88E-08	BET-	-0.24	n/a	> 0.05	n/a	> 0.05	n/a	60	3.2	60	0.2	0.8
01644000	154	19.1	3.37E-04	BET+	0.36	n/a	> 0.05	n/a	> 0.05	n/a	61	3.9	61	4.4	18.7
01658500	183	23.4	5.01E-04	BET-	-0.42	n/a	> 0.05	n/a	> 0.05	n/a	59	4.6	59	0.1	0.4
01661050	323	39.9	2.31E-31	BET-	-0.46	n/a	> 0.05	n/a	> 0.05	n/a	42	3.1	42	0.3	0.9
01661800	31	24.3	2.39E-06	BET-	-1.74	n/a	> 0.05	n/a	> 0.05	n/a	22	2.5	22	0.1	0.4
01662800	148	27.1	1.12E-32	BET-	-2.77	n/a	> 0.05	n/a	> 0.05	n/a	52	3.4	52	0.4	1.4
01664000	121	17.8	> 0.05	BEV	no trend	0.19	> 0.05	n/a	> 0.05	n/a	61	3.2	61	11.4	36.1
01665500	155	22.1	2.40E-06	BET+	0.93	n/a	> 0.05	n/a	> 0.05	n/a	61	3.1	61	2.5	7.8
01666500	161	25.9	> 0.05	BEV	no trend	0.12	> 0.05	n/a	> 0.05	n/a	61	2.7	61	3.7	10.9
01667500	147	20.6	> 0.05	BEV	no trend	0.10	> 0.05	n/a	> 0.05	n/a	61	3.0	61	9.0	27.8
01669520	132	21.2	> 0.05	BEV	no trend	0.39	> 0.05	n/a	> 0.05	n/a	29	2.8	29	2.3	6.7
02011400	161	35.9	1.49E-07	BET+	0.25	n/a	> 0.05	n/a	> 0.05	n/a	36	3.8	36	2.3	9.2
02011460	153	33.4	1.11E-04	BET-	-0.46	n/a	> 0.05	n/a	> 0.05	n/a	36	4.8	36	1.2	5.6
02013000	148	31.4	4.65E-03	BET-	-0.22	n/a	> 0.05	n/a	> 0.05	n/a	61	4.9	61	1.7	10.4
02014000	138	29.5	9.95E-04	BET-	-0.62	n/a	> 0.05	n/a	> 0.05	n/a	61	4.0	61	2.3	10.7
02016000	128	59.4	1.03E-02	BET-	-0.59	n/a	> 0.05	n/a	> 0.05	n/a	61	4.2	61	7.0	31.4
02017500	137	20.8	1.58E-02	BET-	-0.60	n/a	> 0.05	n/a	> 0.05	n/a	61	5.1	61	1.4	8.0
02018000	118	16.8	> 0.05	BEV	no trend	0.09	> 0.05	n/a	> 0.05	n/a	61	4.4	61	4.6	23.9
02030500	535	59.2	3.73E-07	BET+	0.15	n/a	> 0.05	n/a	> 0.05	n/a	61	3.0	61	3.1	10.1
02032640	131	18.2	1.61E-14	BET-	-1.05	n/a	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
02038850	124	16.3	> 0.05	BEV	no trend	0.05	> 0.05	n/a	> 0.05	n/a	44	2.4	44	0.1	0.3
02046000	212	29.2	8.93E-07	BET-	-0.41	n/a	> 0.05	n/a	> 0.05	n/a	61	4.6	61	1.3	6.0
02051000	197	27.9	5.31E-11	BET-	-0.47	n/a	> 0.05	n/a	> 0.05	n/a	61	4.5	61	0.5	2.3
02053200	558	57.7	8.30E-14	BET+	0.60	n/a	1.01E-02	-2.65E-02	> 0.05	n/a	51	8.2	51	2.2	17.8
02053800	222	29.2	3.11E-15	BET-	-0.66	n/a	> 0.05	n/a	> 0.05	n/a	50	2.8	50	1.9	5.9
02055100	359	52.8	2.18E-24	BET-	-0.19	n/a	> 0.05	n/a	> 0.05	n/a	54	3.1	54	0.2	0.6
02056900	241	31.8	4.78E-22	BET-	-0.43	n/a	> 0.05	n/a	> 0.05	n/a	34	2.5	34	2.3	6.0
02059500	212	30.5	5.59E-16	BET-	-0.64	n/a	> 0.05	n/a	> 0.05	n/a	61	2.6	61	2.9	8.2
02064000	201	29.8	> 0.05	BEV	no trend	0.08	> 0.05	n/a	> 0.05	n/a	61	2.7	61	2.5	7.1
02065500	204	37.8	1.12E-04	BET+	0.25	n/a	> 0.05	n/a	> 0.05	n/a	61	2.5	61	1.7	4.2
02069700	198	27.9	> 0.05	BEV	no trend	0.09	> 0.05	n/a	> 0.05	n/a	48	2.0	48	2.8	5.5
02070000	188	27.9	> 0.05	BEV	no trend	0.07	> 0.05	n/a	> 0.05	n/a	61	2.0	61	2.7	5.2
02070500	287	60.9	2.48E-13	BET+	0.18	n/a	> 0.05	n/a	> 0.05	n/a	61	1.9	61	6.3	12.8
02074500	148	26.5	2.38E-07	BET+	0.59	n/a	> 0.05	n/a	> 0.05	n/a	61	2.2	61	1.9	4.4
02077200	398	47.3	2.48E-42	BET-	-0.90	n/a	> 0.05	n/a	> 0.05	n/a	46	5.4	46	0.4	2.3
02081500	495	59.7	3.23E-08	BET+	0.14	n/a	> 0.05	n/a	> 0.05	n/a	61	7.3	61	1.0	7.8
02082770	426	47.7	> 0.05	BEV	no trend	0.11	> 0.05	n/a	> 0.05	n/a	47	3.4	47	2.6	8.8
02084160	240	34.9	4.87E-12	BET-	-0.74	n/a	> 0.05	n/a	> 0.05	n/a	35	7.9	35	0.3	3.0

STAID	BE N msts	BE years	BE p	BE type	BET (cm/y)	BEV (m)	Q_{50}trend p	Q_{50}trend ($m^3/s/y$)	Q_{90}trend p	Q_{90}trend ($m^3/s/y$)	Q_{90}&Q_{50} years	Q_{90}/Q_{50}	Q_{90}/Q_{50} years	Q_{50} (m^3/s)	Q_{90} (m^3/s)
02084557	238	34.4	> 0.05	BEV	no trend	0.05	> 0.05	n/a	> 0.05	n/a	33	6.7	33	0.2	1.8
02091000	245	28.6	6.48E-10	BET+	0.85	n/a	4.55E-02	-6.89E-03	> 0.05	n/a	56	3.7	56	1.3	4.3
02092500	240	25.0	> 0.05	BEV	no trend	0.28	> 0.05	n/a	> 0.05	n/a	60	5.6	60	1.9	13.0
02096846	186	23.0	1.88E-21	BET-	-0.98	n/a	6.66E-04	-2.62E-03	4.62E-04	-1.18E-02	22	8.4	22	0.0	0.3
02102908	218	28.1	1.61E-28	BET-	-0.48	n/a	9.45E-04	-2.55E-03	7.81E-03	-4.07E-03	42	1.9	42	0.3	0.5
02105900	143	14.9	> 0.05	BEV	no trend	0.11	> 0.05	n/a	1.66E-02	-1.60E-02	52	5.1	52	0.4	2.2
02108000	116	24.7	3.79E-08	BET-	-1.69	n/a	> 0.05	n/a	> 0.05	n/a	61	3.7	61	10.8	44.2
02110500	345	60.5	1.60E-08	BET-	-1.15	n/a	> 0.05	n/a	> 0.05	n/a	60	4.1	60	17.0	82.4
02111180	141	43.6	2.01E-02	BET+	0.10	n/a	2.25E-02	-1.70E-02	> 0.05	n/a	45	2.3	45	2.0	4.4
02111500	159	26.9	5.56E-23	BET-	-0.50	n/a	> 0.05	n/a	> 0.05	n/a	61	1.9	61	3.2	5.7
02112120	136	28.2	> 0.05	BEV	no trend	0.03	> 0.05	n/a	> 0.05	n/a	46	1.9	46	4.0	8.6
02112360	348	59.0	2.78E-02	BET-	-0.08	n/a	> 0.05	n/a	> 0.05	n/a	46	1.7	46	2.9	5.3
02118500	648	60.6	2.73E-159	BET-	-0.96	n/a	> 0.05	n/a	> 0.05	n/a	60	2.1	60	4.0	8.2
02125000	503	54.5	4.08E-05	BET-	-0.05	n/a	> 0.05	n/a	> 0.05	n/a	54	9.4	54	0.3	3.1
02128000	525	61.3	7.24E-44	BET+	0.23	n/a	> 0.05	n/a	> 0.05	n/a	56	3.8	56	1.2	5.0
02137727	207	38.4	5.59E-23	BET+	0.74	n/a	> 0.05	n/a	> 0.05	n/a	30	2.2	30	4.8	10.9
02140991	184	35.7	2.43E-15	BET+	0.99	n/a	> 0.05	n/a	> 0.05	n/a	25	2.3	25	6.9	17.0
02142000	190	52.7	4.65E-23	BET-	-0.21	n/a	> 0.05	n/a	> 0.05	n/a	58	2.2	58	0.8	1.7
02143000	166	46.7	2.89E-02	BET+	0.17	n/a	> 0.05	n/a	> 0.05	n/a	61	2.3	61	2.8	5.9
02143040	174	29.3	5.80E-09	BET-	-0.18	n/a	1.46E-02	-7.17E-03	> 0.05	n/a	49	2.5	49	0.9	2.3
02147126	104	34.7	1.20E-13	BET-	-0.94	n/a	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
02149000	227	39.2	> 0.05	BEV	no trend	0.12	> 0.05	n/a	> 0.05	n/a	60	2.0	60	2.9	5.6
02152100	265	35.7	1.41E-03	BET-	-0.05	n/a	1.03E-02	-1.28E-02	> 0.05	n/a	51	2.2	51	1.9	3.9
02167450	136	18.5	6.28E-03	BET+	0.47	n/a	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
02177000	500	59.9	3.99E-04	BET+	0.08	n/a	> 0.05	n/a	> 0.05	n/a	61	2.0	61	15.6	31.8
02178400	348	43.9	1.31E-07	BET-	-0.10	n/a	> 0.05	n/a	> 0.05	n/a	46	2.1	46	4.1	9.2
02193340	188	22.3	4.45E-25	BET-	-0.76	n/a	4.32E-02	-7.26E-03	> 0.05	n/a	24	4.3	24	0.2	1.0
02198100	195	25.5	> 0.05	BEV	no trend	0.10	1.52E-02	-8.40E-03	> 0.05	n/a	24	4.7	24	0.2	1.2
02198690	146	21.8	1.04E-04	BET+	0.69	n/a	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
02202600	273	48.5	> 0.05	BEV	no trend	0.32	> 0.05	n/a	> 0.05	n/a	30	14.8	30	0.5	9.7
02204130	44	29.9	2.05E-04	BET-	-1.48	n/a	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
02212600	398	46.5	4.67E-02	BET+	0.08	n/a	8.32E-03	-8.60E-03	> 0.05	n/a	44	5.7	44	0.5	3.1
02216180	193	27.3	> 0.05	BEV	no trend	0.55	> 0.05	n/a	> 0.05	n/a	28	26.2	27	0.1	2.9
02221525	268	31.2	1.15E-03	BET-	-0.23	n/a	> 0.05	n/a	> 0.05	n/a	33	3.3	33	2.2	7.5
02228500	394	58.8	3.42E-02	BET+	0.00	n/a	> 0.05	n/a	> 0.05	n/a	60	6.7	60	1.2	9.3
02231000	394	58.1	> 0.05	BEV	no trend	0.43	> 0.05	n/a	> 0.05	n/a	61	5.4	61	6.3	36.7
02231342	143	30.2	> 0.05	BEV	no trend	0.11	> 0.05	n/a	> 0.05	n/a	33	9.7	33	0.4	3.4
02236500	306	56.5	5.94E-03	BET-	-0.17	n/a	2.45E-02	-1.10E-02	> 0.05	n/a	52	6.2	52	0.1	1.1
02245500	405	58.7	1.09E-21	BET-	-0.35	n/a	2.75E-02	-1.40E-02	> 0.05	n/a	61	4.2	61	1.8	7.9
02246150	249	43.1	2.42E-04	BET-	-0.20	n/a	> 0.05	n/a	> 0.05	n/a	39	4.4	39	0.2	0.6
02266200	148	43.7	3.65E-05	BET-	-0.23	n/a	1.28E-02	3.21E-03	2.74E-02	1.48E-02	43	8.7	42	0.0	0.3
02268390	132	18.5	> 0.05	BEV	no trend	0.14	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
02295013	170	44.5	> 0.05	BEV	no trend	0.17	> 0.05	n/a	> 0.05	n/a	45	9.5	45	0.2	1.9
02296500	461	59.7	1.01E-50	BET-	-1.13	n/a	> 0.05	n/a	> 0.05	n/a	60	9.0	60	1.6	17.4
02297155	222	34.3	4.57E-02	BET-	-0.14	n/a	> 0.05	n/a	> 0.05	n/a	32	9.9	32	0.1	2.1
02297310	496	59.7	4.54E-03	BET+	0.08	n/a	> 0.05	n/a	> 0.05	n/a	59	10.2	59	1.1	12.5
02298123	338	48.8	4.77E-22	BET-	-1.13	n/a	> 0.05	n/a	> 0.05	n/a	46	7.6	46	1.8	14.3
02298530	70	12.0	3.85E-12	BET+	1.05	n/a	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
02299950	298	42.5	3.11E-02	BET+	0.06	n/a	> 0.05	n/a	> 0.05	n/a	44	9.1	44	0.5	4.8
02300700	306	52.1	> 0.05	BEV	no trend	0.27	> 0.05	n/a	> 0.05	n/a	53	4.6	53	0.5	2.4
02310147	187	27.2	1.87E-04	BET-	-0.03	n/a	> 0.05	n/a	> 0.05	n/a	25	6.3	25	0.0	0.2
02312200	313	52.7	1.22E-23	BET-	-0.73	n/a	2.62E-02	-2.02E-02	> 0.05	n/a	52	8.0	51	0.5	4.5
02313700	122	25.4	9.43E-05	BET-	-0.69	n/a	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
02315000	113	54.2	> 0.05	BEV	no trend	0.20	> 0.05	n/a	> 0.05	n/a	35	6.9	35	13.5	90.7
02321000	94	38.5	> 0.05	BEV	no trend	0.23	> 0.05	n/a	> 0.05	n/a	61	9.5	61	0.6	7.9
02322700	116	32.7	2.79E-14	BET+	1.62	n/a	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
02324000	327	58.7	> 0.05	BEV	no trend	0.21	1.96E-02	-4.96E-02	> 0.05	n/a	60	5.0	60	3.4	22.3
02324400	179	51.3	5.19E-07	BET-	-2.45	n/a	2.89E-02	-9.28E-03	5.80E-03	-5.80E-02	55	6.4	55	0.5	3.1
02326000	148	53.0	4.43E-04	BET-	-0.58	n/a	> 0.05	n/a	> 0.05	n/a	60	4.0	60	1.6	9.2
02327033	66	34.3	> 0.05	BEV	no trend	0.20	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
02327100	160	35.5	2.06E-05	BET-	-0.86	n/a	3.75E-02	-2.69E-02	4.92E-02	-1.12E-01	46	8.0	46	1.3	13.2
02330400	47	11.6	> 0.05	BEV	no trend	0.20	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
02331000	236	45.6	3.62E-08	BET-	-0.20	n/a	> 0.05	n/a	> 0.05	n/a	61	2.0	61	9.3	18.0
02342933	220	33.7	1.81E-26	BET+	0.86	n/a	> 0.05	n/a	> 0.05	n/a	46	6.7	46	0.9	5.8
02343225	29	60.4	> 0.05	BEV	no trend	0.57	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
02343940	51	29.7	2.14E-05	BET+	1.29	n/a	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
02350600	337	59.7	> 0.05	BEV	no trend	0.79	> 0.05	n/a	> 0.05	n/a	59	2.9	59	3.7	11.0
02362240	179	26.4	4.20E-04	BET-	-0.81	n/a	> 0.05	n/a	> 0.05	n/a	25	2.5	25	0.6	1.5
02363000	161	23.8	> 0.05	BEV	no trend	0.08	> 0.05	n/a	> 0.05	n/a	61	5.2	61	6.6	36.2
02365470	63	27.0	2.60E-02	BET-	-0.65	n/a	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
02365769	64	12.7	5.07E-04	BET-	-1.20	n/a	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
02369800	207	29.3	7.77E-15	BET-	-0.72	n/a	> 0.05	n/a	> 0.05	n/a	43	3.1	43	2.3	7.0
02370000	142	60.5	3.33E-19	BET-	-1.60	n/a	> 0.05	n/a	> 0.05	n/a	60	3.1	60	5.7	17.2
02371500	216	31.8	2.40E-07	BET-	-0.55	n/a	> 0.05	n/a	> 0.05	n/a	61	4.8	61	7.8	38.3
02372250	216	32.3	3.46E-02	BET-	-0.61	n/a	> 0.05	n/a	> 0.05	n/a	36	4.7	36	8.0	35.3
02373000	207	29.1	> 0.05	BEV	no trend	0.23	> 0.05	n/a	> 0.05	n/a	61	7.4	61	5.6	43.7
02373000	89	18.6	5.83E-03	BET-	-2.66	n/a	3.77E-02	1.22E-01	> 0.05	n/a	61	4.1	61	21.2	101.7
02374500	176	31.2	> 0.05	BEV	no trend	0.19	> 0.05	n/a	> 0.05	n/a	61	2.6	61	5.2	13.7
02381600	276	43.3	3.78E-03	BET+	0.07	n/a	5.02E-04	-5.79E-03	9.06E-03	-1.15E-02	34	2.4	34	0.3	0.8
02384540	197	24.3	7.84E-05	BET-	-0.45	n/a	> 0.05	n/a	> 0.05	n/a	25	3.7	25	0.2	1.0
02388900	39	59.0	> 0.05	BEV	no trend	0.07	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
02390000	35	58.6	3.93E-04	BET+	0.43	n/a	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
02395120	230	28.3	5.22E-05	BET+	0.29	n/a	> 0.05	n/a	> 0.05	n/a	30	3.1	30	0.7	2.1
02408540	186	28.6	2.52E-08	BET-	-0.75	n/a	> 0.05	n/a	> 0.05	n/a	30	3.6	30	6.1	22.7
02422500	196	26.2	7.76E-41	BET-	-1.60	n/a	> 0.05	n/a	> 0.05	n/a	61	3.5	61	4.1	14.8
02427250	156	50.8	1.53E-15	BET-	-0.62	n/a	> 0.05	n/a	4.92E-02	-5.28E-01	21	5.2	21	3.3	17.5
02429980	268	31.3	6.54E-07	BET+	0.28	n/a	> 0.05	n/a	1.03E-02	-5.37E-03	30	1.8	30	0.1	0.2
02430085	301	34.1	8.99E-60	BET+	1.37	n/a	> 0.05	n/a	> 0.05	n/a	35	3.6	35	0.4	1.5
02430615	243	29.1	> 0.05	BEV	no trend	0.15	> 0.05	n/a	> 0.05	n/a	34	2.7	34	0.3	0.8
02430880	305	33.7	1.50E-61	BET-	-1.33	n/a	> 0.05	n/a	> 0.05	n/a	35	2.4	35	0.6	1.4

STAID	BE N msts	BE years	BE p	BE type	BET (cm/y)	BEV (m)	Q_{50}trend p	Q_{50}trend ($m^3/s/y$)	Q_{90}trend p	Q_{90}trend ($m^3/s/y$)	Q_{90}&Q_{50} years	Q_{90}/Q_{50}	Q_{90}/Q_{50} years	Q_{50} (m^3/s)	Q_{90} (m^3/s)
02438000	312	54.8	1.26E-12	BET+	0.28	n/a	> 0.05	n/a	> 0.05	n/a	60	5.1	60	6.1	30.4
02448900	155	20.7	> 0.05	BEV	no trend	0.14	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
02464146	256	27.6	8.14E-03	BET-	-0.03	n/a	> 0.05	n/a	> 0.05	n/a	29	3.9	29	0.1	0.5
02464360	191	24.6	4.83E-06	BET+	0.35	n/a	> 0.05	n/a	> 0.05	n/a	24	3.4	24	1.4	4.8
02465493	272	31.9	4.42E-15	BET-	-0.51	n/a	> 0.05	n/a	> 0.05	n/a	34	2.5	34	0.8	2.0
02467500	208	28.5	1.68E-25	BET-	-2.81	n/a	> 0.05	n/a	> 0.05	n/a	60	5.4	60	9.2	54.1
02469800	199	28.5	6.66E-07	BET-	-0.88	n/a	> 0.05	n/a	> 0.05	n/a	54	5.1	54	2.5	12.3
02470072	71	13.3	1.20E-07	BET-	-3.33	n/a	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
02472000	553	61.2	1.85E-09	BET-	-0.38	n/a	> 0.05	n/a	> 0.05	n/a	60	6.6	60	9.5	74.4
02472500	596	61.2	2.50E-02	BET+	0.28	n/a	> 0.05	n/a	> 0.05	n/a	61	3.2	61	6.0	20.5
02472850	149	46.4	> 0.05	BEV	no trend	0.13	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
02479155	227	29.1	8.39E-03	BET+	0.24	n/a	> 0.05	n/a	> 0.05	n/a	44	5.3	44	1.0	5.1
02479300	227	29.8	2.20E-03	BET-	-0.58	n/a	> 0.05	n/a	> 0.05	n/a	52	3.7	52	12.5	49.0
02479560	190	29.1	> 0.05	BEV	no trend	0.67	2.49E-03	-2.94E-01	2.66E-02	-8.35E-01	37	4.2	37	15.4	71.4
02479945	136	18.2	6.04E-16	BET-	-1.15	n/a	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
02483500	138	17.5	> 0.05	BEV	no trend	1.21	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
02488700	205	49.9	1.31E-08	BET-	-0.78	n/a	> 0.05	n/a	> 0.05	n/a	37	2.2	37	3.6	8.2
03010655	255	33.9	2.70E-05	BET+	0.30	n/a	> 0.05	n/a	> 0.05	n/a	36	4.0	36	2.7	9.8
03011800	372	42.9	5.51E-13	BET-	-0.27	n/a	> 0.05	n/a	> 0.05	n/a	45	3.4	45	1.4	4.8
03017500	392	60.3	> 0.05	BEV	no trend	0.10	> 0.05	n/a	> 0.05	n/a	28	3.8	28	6.4	27.4
03021350	254	36.7	2.11E-10	BET+	0.44	n/a	> 0.05	n/a	> 0.05	n/a	36	4.9	36	3.0	14.9
03022540	246	36.7	1.01E-05	BET+	0.12	n/a	> 0.05	n/a	> 0.05	n/a	19	4.2	19	0.8	3.4
03025000	405	58.5	2.66E-85	BET+	1.71	n/a	> 0.05	n/a	> 0.05	n/a	28	4.0	28	4.5	17.5
03026500	531	59.7	5.99E-06	BET-	-0.06	n/a	> 0.05	n/a	> 0.05	n/a	59	3.9	59	0.2	0.9
03028000	481	57.1	1.72E-10	BET-	-0.10	n/a	> 0.05	n/a	> 0.05	n/a	57	3.9	57	2.1	8.0
03049000	537	58.6	1.98E-02	BET+	0.01	n/a	> 0.05	n/a	> 0.05	n/a	61	5.1	61	2.6	12.6
03050000	152	61.8	> 0.05	BEV	no trend	0.22	> 0.05	n/a	> 0.05	n/a	61	5.2	61	4.9	23.3
03065000	131	56.1	> 0.05	BEV	no trend	0.47	3.80E-02	5.91E-02	> 0.05	n/a	61	4.2	61	12.0	49.1
03065400	81	19.1	1.46E-02	BET-	-0.33	n/a	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
03068800	85	39.6	> 0.05	BEV	no trend	0.34	> 0.05	n/a	> 0.05	n/a	37	3.8	37	7.3	27.3
03069500	128	23.8	> 0.05	BEV	no trend	0.24	> 0.05	n/a	> 0.05	n/a	61	3.9	61	28.3	111.1
03069870	66	11.4	> 0.05	BEV	no trend	1.50	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
03070500	201	50.3	2.69E-04	BET-	-0.16	n/a	> 0.05	n/a	> 0.05	n/a	60	4.4	60	6.1	26.7
03076600	386	43.9	3.65E-02	BET+	0.09	n/a	> 0.05	n/a	> 0.05	n/a	46	4.5	46	1.4	6.1
03078000	584	61.9	3.90E-21	BET-	-0.20	n/a	> 0.05	n/a	> 0.05	n/a	60	4.2	60	1.9	7.8
03114500	68	25.0	> 0.05	BEV	no trend	0.14	> 0.05	n/a	> 0.05	n/a	61	7.6	61	5.7	42.3
03115400	96	50.1	> 0.05	BEV	no trend	0.22	> 0.05	n/a	> 0.05	n/a	51	8.1	51	2.2	16.3
03121850	79	10.9	2.43E-04	BET-	-0.81	n/a	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
03140000	113	18.1	2.49E-09	BET+	0.88	n/a	3.68E-02	2.54E-03	> 0.05	n/a	61	5.3	61	0.3	1.6
03144000	109	19.1	> 0.05	BEV	no trend	0.06	> 0.05	n/a	> 0.05	n/a	61	5.3	61	1.7	9.3
03154000	36	16.9	> 0.05	BEV	no trend	0.19	> 0.05	n/a	> 0.05	n/a	24	9.1	24	1.8	16.6
03158200	78	14.4	> 0.05	BEV	no trend	0.10	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
03159540	123	21.1	> 0.05	BEV	no trend	0.20	> 0.05	n/a	> 0.05	n/a	45	7.0	45	1.4	9.8
03161000	129	27.7	3.84E-02	BET+	0.34	n/a	> 0.05	n/a	> 0.05	n/a	61	1.9	61	10.0	18.8
03164000	129	51.4	> 0.05	BEV	no trend	0.03	> 0.05	n/a	> 0.05	n/a	61	2.3	61	41.9	93.6
03165000	137	36.2	4.06E-06	BET+	0.16	n/a	> 0.05	n/a	> 0.05	n/a	61	1.9	61	1.5	2.9
03167500	55	35.5	2.49E-04	BET-	-0.07	n/a	> 0.05	n/a	> 0.05	n/a	44	2.0	44	9.1	17.2
03170000	155	60.4	9.21E-06	BET-	-0.33	n/a	> 0.05	n/a	> 0.05	n/a	61	2.1	61	7.5	16.7
03173000	429	60.1	7.52E-16	BET-	-0.30	n/a	> 0.05	n/a	> 0.05	n/a	61	4.3	61	4.0	19.6
03180500	159	56.7	> 0.05	BEV	no trend	0.12	> 0.05	n/a	> 0.05	n/a	59	4.3	59	4.0	16.7
03182500	180	60.9	5.64E-10	BET-	-0.35	n/a	> 0.05	n/a	> 0.05	n/a	61	4.8	61	11.5	57.7
03186500	157	57.7	4.40E-05	BET-	-0.45	n/a	> 0.05	n/a	> 0.05	n/a	59	4.1	59	5.4	21.4
03187000	46	29.1	> 0.05	BEV	no trend	0.14	> 0.05	n/a	> 0.05	n/a	24	4.2	24	9.0	38.1
03187500	161	24.6	2.53E-02	BET+	0.24	n/a	> 0.05	n/a	> 0.05	n/a	61	3.7	61	3.8	14.5
03201902	62	27.1	3.92E-06	BET-	-3.06	n/a	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
03207965	228	34.9	6.97E-12	BET-	-0.17	n/a	> 0.05	n/a	> 0.05	n/a	37	4.5	37	0.1	0.4
03213700	286	44.1	9.72E-11	BET-	-0.76	n/a	> 0.05	n/a	> 0.05	n/a	43	3.9	43	16.4	65.9
03228750	56	11.2	> 0.05	BEV	no trend	0.14	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
03237255	46	10.9	> 0.05	BEV	no trend	0.16	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
03237500	162	61.4	4.66E-06	BET-	-0.74	n/a	> 0.05	n/a	> 0.05	n/a	60	8.5	60	3.1	27.5
03238500	101	33.5	> 0.05	BEV	no trend	0.17	> 0.05	n/a	> 0.05	n/a	60	11.6	60	1.3	14.7
03241500	117	21.3	> 0.05	BEV	no trend	0.08	3.32E-03	9.03E-03	> 0.05	n/a	57	4.6	57	0.9	4.0
03251200	132	20.0	2.61E-02	BET+	1.26	n/a	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
03252300	134	40.9	> 0.05	BEV	no trend	0.16	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
03272700	100	17.9	8.94E-06	BET+	0.51	n/a	> 0.05	n/a	> 0.05	n/a	40	6.0	40	0.8	4.8
03280700	477	52.9	> 0.05	BEV	no trend	0.17	> 0.05	n/a	> 0.05	n/a	53	6.0	53	0.8	5.2
03281040	237	28.1	6.63E-12	BET-	-0.43	n/a	> 0.05	n/a	> 0.05	n/a	26	5.8	26	2.8	15.6
03281100	384	49.1	> 0.05	BEV	no trend	0.21	> 0.05	n/a	> 0.05	n/a	45	6.0	45	2.7	14.3
03282040	129	17.2	1.96E-02	BET+	0.28	n/a	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
03282500	458	54.2	5.20E-08	BET-	-0.23	n/a	> 0.05	n/a	> 0.05	n/a	56	6.2	56	0.8	5.5
03285000	502	61.1	> 0.05	BEV	no trend	0.29	> 0.05	n/a	> 0.05	n/a	61	8.8	61	4.0	28.6
03291780	222	41.0	4.81E-02	BET+	0.24	n/a	> 0.05	n/a	> 0.05	n/a	40	8.5	40	0.3	2.3
03300400	316	45.9	3.26E-10	BET-	-0.30	n/a	> 0.05	n/a	> 0.05	n/a	38	7.8	38	4.8	37.7
03302050	53	12.2	1.39E-02	BET+	1.15	n/a	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
03302110	112	18.2	3.06E-05	BET-	-0.73	n/a	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
03302680	174	26.2	2.86E-02	BET+	0.21	n/a	> 0.05	n/a	> 0.05	n/a	40	6.7	40	0.2	1.7
03338780	165	25.7	1.29E-08	BET-	-0.74	n/a	> 0.05	n/a	> 0.05	n/a	22	5.5	22	3.4	18.5
03340800	343	53.7	8.13E-03	BET+	0.08	n/a	> 0.05	n/a	> 0.05	n/a	52	5.3	52	1.5	7.4
03357330	70	10.1	> 0.05	BEV	no trend	0.10	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
03357350	133	23.9	2.17E-04	BET+	0.36	n/a	> 0.05	n/a	> 0.05	n/a	39	8.1	39	0.0	0.2
03364500	211	53.9	7.03E-28	BET-	-0.76	n/a	1.24E-02	9.31E-03	3.34E-02	4.28E-02	61	6.7	61	1.0	6.0
03384450	231	43.9	1.95E-03	BET-	-0.25	n/a	> 0.05	n/a	> 0.05	n/a	43	11.6	43	0.3	2.9
03408500	420	58.4	> 0.05	BEV	no trend	0.15	> 0.05	n/a	> 0.05	n/a	61	5.2	61	8.5	41.8
03409500	142	25.1	4.86E-02	BET-	-0.17	n/a	> 0.05	n/a	> 0.05	n/a	61	6.1	61	4.8	28.9
03410210	111	27.8	6.50E-03	BET-	-0.64	n/a	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
03413200	281	40.0	9.30E-12	BET+	0.13	n/a	4.90E-02	-6.08E-03	> 0.05	n/a	42	6.4	42	0.6	3.7
03416000	126	25.1	> 0.05	BEV	no trend	0.09	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
03424730	142	19.8	3.05E-06	BET+	0.56	n/a	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
03427500	162	25.0	> 0.05	BEV	no trend	0.14	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
03431800	104	16.5	4.53E-13	BET-	-1.94	n/a	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.

STAID	BE N msts	BE years	BE p	BE type	BET (cm/y)	BEV (m)	Q_{50}trend p	Q_{50}trend (m^3/s/y)	Q_{90}trend p	Q_{90}trend (m^3/s/y)	Q_{90}&Q_{50} years	Q_{90}/Q_{50}	Q_{90}/Q_{50} years	Q_{50} (m^3/s)	Q_{90} (m^3/s)
03436690	149	25.3	1.87E-19	BET-	-0.89	n/a	> 0.05	n/a	> 0.05	n/a	30	4.0	30	1.9	8.8
03439000	548	60.8	> 0.05	BEV	no trend	0.15	> 0.05	n/a	> 0.05	n/a	61	2.0	61	5.4	11.1
03441000	526	60.6	1.57E-03	BET-	-0.01	n/a	> 0.05	n/a	> 0.05	n/a	61	2.2	61	2.8	6.2
03455500	570	55.8	2.59E-34	BET-	-0.26	n/a	> 0.05	n/a	> 0.05	n/a	56	2.5	56	2.0	5.1
03456500	542	54.9	> 0.05	BEV	no trend	0.11	> 0.05	n/a	> 0.05	n/a	56	2.6	56	2.8	7.3
03460000	432	61.5	6.10E-07	BET-	-0.05	n/a	> 0.05	n/a	> 0.05	n/a	61	2.4	61	2.4	5.5
03463300	454	51.1	7.79E-14	BET+	0.17	n/a	> 0.05	n/a	> 0.05	n/a	53	2.5	53	2.7	6.8
03465500	174	25.4	1.21E-14	BET-	-2.79	n/a	> 0.05	n/a	> 0.05	n/a	61	2.6	61	29.0	70.1
03471500	135	19.4	3.46E-02	BET-	-0.08	n/a	> 0.05	n/a	> 0.05	n/a	61	3.2	61	1.9	6.2
03473000	144	20.7	> 0.05	BEV	no trend	0.09	> 0.05	n/a	> 0.05	n/a	61	3.1	61	8.3	27.7
03479000	159	26.9	8.37E-04	BET-	-0.12	n/a	> 0.05	n/a	> 0.05	n/a	61	2.7	61	3.3	8.7
03488000	180	35.7	3.22E-03	BET-	-0.14	n/a	> 0.05	n/a	> 0.05	n/a	61	4.2	61	4.4	17.5
03491000	218	28.2	3.42E-03	BET-	-0.22	n/a	> 0.05	n/a	> 0.05	n/a	53	5.5	53	0.7	3.3
03497300	180	25.1	9.23E-06	BET-	-0.31	n/a	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
03498500	222	25.0	3.57E-24	BET-	-1.32	n/a	> 0.05	n/a	> 0.05	n/a	59	3.1	59	8.9	26.7
03500000	122	35.0	3.13E-02	BET-	-0.15	n/a	> 0.05	n/a	> 0.05	n/a	61	2.1	61	8.5	18.9
03500240	423	56.9	> 0.05	BEV	no trend	0.08	> 0.05	n/a	> 0.05	n/a	49	2.2	49	3.0	7.2
03504000	146	29.9	> 0.05	BEV	no trend	0.06	> 0.05	n/a	> 0.05	n/a	61	2.1	61	4.4	10.4
03535000	74	25.9	> 0.05	BEV	no trend	0.14	> 0.05	n/a	> 0.05	n/a	53	4.2	53	1.1	4.9
03539778	54	11.1	> 0.05	BEV	no trend	0.05	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
03544947	185	23.2	> 0.05	BEV	no trend	0.07	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
03574500	627	58.9	4.73E-42	BET+	1.12	n/a	> 0.05	n/a	> 0.05	n/a	61	6.8	61	6.1	43.7
03588500	163	38.1	1.27E-09	BET+	1.03	n/a	> 0.05	n/a	> 0.05	n/a	60	3.7	60	9.6	33.7
03592718	249	29.1	9.07E-15	BET-	-1.50	n/a	> 0.05	n/a	> 0.05	n/a	36	3.7	36	0.5	1.9
03597210	156	21.1	> 0.05	BEV	no trend	0.13	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
03597590	163	19.1	> 0.05	BEV	no trend	0.11	> 0.05	n/a	> 0.05	n/a	21	11.4	21	0.4	3.1
03604000	214	61.8	8.20E-08	BET-	-0.53	n/a	2.04E-02	5.71E-02	> 0.05	n/a	61	3.1	61	12.3	38.7
04015330	332	34.2	2.68E-07	BET-	-0.38	n/a	> 0.05	n/a	> 0.05	n/a	36	8.9	36	0.6	5.7
04024430	142	23.3	> 0.05	BEV	no trend	0.46	> 0.05	n/a	> 0.05	n/a	37	5.5	37	3.8	23.9
04027000	304	51.5	> 0.05	BEV	no trend	0.58	> 0.05	n/a	3.92E-03	-2.54E-01	61	4.6	61	7.4	35.2
04033000	322	58.3	1.45E-08	BET+	0.20	n/a	7.28E-03	-1.65E-02	5.06E-04	-5.35E-02	61	2.2	61	3.5	7.6
04040500	799	59.1	8.23E-53	BET-	-0.32	n/a	> 0.05	n/a	> 0.05	n/a	60	4.8	60	2.7	13.4
04043050	219	21.7	1.73E-13	BET-	-0.99	n/a	> 0.05	n/a	1.97E-02	-1.47E-02	44	3.9	44	0.6	2.2
04045500	158	51.4	> 0.05	BEV	no trend	1.26	> 0.05	n/a	> 0.05	n/a	57	2.9	57	16.4	50.8
04046000	144	27.3	1.30E-05	BET+	0.34	n/a	> 0.05	n/a	> 0.05	n/a	59	3.0	59	0.5	1.5
04056500	189	22.9	> 0.05	BEV	no trend	0.30	> 0.05	n/a	> 0.05	n/a	61	2.5	61	28.0	75.1
04057510	210	24.2	1.18E-02	BET+	0.32	n/a	3.20E-02	-2.06E-02	1.77E-03	-9.71E-02	43	2.8	43	3.4	10.1
04057800	225	23.4	2.58E-02	BET+	0.15	n/a	> 0.05	n/a	> 0.05	n/a	50	4.3	50	0.8	3.2
04059500	259	25.7	6.97E-03	BET+	0.37	n/a	> 0.05	n/a	> 0.05	n/a	56	5.0	56	4.7	24.3
04067958	67	11.4	2.69E-02	BET-	-0.99	n/a	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
04073462	113	12.1	3.55E-02	BET+	0.17	n/a	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
04074538	131	28.7	8.26E-15	BET-	-0.74	n/a	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
04085119	55	17.7	> 0.05	BEV	no trend	0.05	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
04085200	388	48.0	4.09E-10	BET+	0.16	n/a	> 0.05	n/a	> 0.05	n/a	44	5.1	44	0.8	4.1
04102776	130	16.8	> 0.05	BEV	no trend	0.13	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
04104945	157	17.3	3.70E-20	BET+	0.99	n/a	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
04105700	430	46.1	1.66E-07	BET+	0.19	n/a	> 0.05	n/a	> 0.05	n/a	46	1.6	46	1.2	1.8
04115265	188	24.0	4.74E-04	BET-	-0.29	n/a	> 0.05	n/a	> 0.05	n/a	22	1.8	22	0.8	1.4
04117000	118	13.9	4.72E-03	BET+	0.27	n/a	4.57E-05	9.58E-04	1.64E-04	2.23E-03	56	2.4	56	0.1	0.3
04122200	173	26.3	4.83E-05	BET+	1.26	n/a	> 0.05	n/a	> 0.05	n/a	53	1.7	53	11.3	18.8
04122500	159	25.9	> 0.05	BEV	no trend	0.33	6.38E-05	8.34E-02	3.37E-04	1.63E-01	61	1.7	61	18.5	30.4
04124000	135	24.8	> 0.05	BEV	no trend	0.43	> 0.05	n/a	> 0.05	n/a	61	1.4	61	27.3	39.4
04124500	129	22.4	1.35E-02	BET-	-0.27	n/a	5.88E-03	5.78E-03	> 0.05	n/a	58	3.0	58	0.6	1.9
04125460	66	11.7	5.05E-08	BET-	-0.68	n/a	3.07E-02	5.97E-03	> 0.05	n/a	58	1.5	58	7.2	10.8
04126970	79	10.9	> 0.05	BEV	no trend	0.03	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
04127918	202	37.1	> 0.05	BEV	no trend	0.44	2.39E-02	-2.79E-02	4.21E-02	-1.01E-01	38	3.2	38	3.4	11.3
04136000	101	16.1	3.21E-03	BET-	-1.21	n/a	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
04150500	149	41.4	> 0.05	BEV	no trend	0.10	5.94E-05	3.62E-02	> 0.05	n/a	60	6.9	60	1.8	14.4
04161580	206	25.0	1.05E-04	BET-	-0.12	n/a	> 0.05	n/a	> 0.05	n/a	46	3.0	46	0.3	1.0
04185000	95	16.8	> 0.05	BEV	no trend	0.27	> 0.05	n/a	2.43E-03	2.27E-01	61	6.5	61	4.1	28.1
04185440	106	19.6	> 0.05	BEV	no trend	0.03	> 0.05	n/a	> 0.05	n/a	25	14.2	25	0.0	0.2
04196800	113	19.4	2.69E-02	BET-	-0.20	n/a	> 0.05	n/a	> 0.05	n/a	44	14.5	44	1.0	15.3
04197100	124	20.7	> 0.05	BEV	no trend	0.06	> 0.05	n/a	> 0.05	n/a	33	11.8	33	0.9	10.5
04197170	111	17.9	> 0.05	BEV	no trend	0.05	> 0.05	n/a	> 0.05	n/a	26	9.6	26	0.2	1.8
04199155	122	23.7	1.19E-17	BET-	-2.17	n/a	> 0.05	n/a	9.37E-03	6.24E-02	23	10.1	23	0.1	1.4
04213000	129	59.2	> 0.05	BEV	no trend	0.07	3.19E-03	2.62E-02	> 0.05	n/a	60	6.3	60	3.1	20.7
04216418	166	25.0	> 0.05	BEV	no trend	0.09	> 0.05	n/a	> 0.05	n/a	31	3.8	31	1.9	7.1
04221000	199	25.4	1.49E-16	BET+	1.08	n/a	> 0.05	n/a	> 0.05	n/a	55	4.2	55	5.9	24.4
04224775	216	25.2	8.29E-06	BET-	-0.46	n/a	> 0.05	n/a	> 0.05	n/a	34	4.3	34	1.5	5.8
04233300	165	17.2	1.12E-20	BET-	-3.76	n/a	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
04245200	147	24.4	5.00E-18	BET+	1.24	n/a	> 0.05	n/a	> 0.05	n/a	39	3.2	39	0.8	2.9
04256000	236	28.5	3.95E-02	BET+	0.36	n/a	5.09E-03	1.56E-02	2.33E-03	4.88E-02	61	3.3	61	3.5	11.4
04268800	143	20.6	> 0.05	BEV	no trend	0.05	1.89E-04	5.32E-02	5.06E-03	1.37E-01	52	2.9	52	6.4	20.7
04273700	301	50.9	6.11E-15	BET-	-0.33	n/a	1.43E-03	1.98E-02	> 0.05	n/a	45	3.1	45	1.1	3.6
04273800	192	51.8	3.80E-02	BET+	0.07	n/a	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
04276842	186	21.5	> 0.05	BEV	no trend	0.14	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
04280350	136	19.0	1.76E-10	BET-	-0.97	n/a	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
04282525	106	21.1	> 0.05	BEV	no trend	0.28	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
04282650	117	21.1	> 0.05	BEV	no trend	0.07	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
04282780	106	19.0	> 0.05	BEV	no trend	0.03	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
04296000	147	58.1	7.00E-07	BET-	-0.26	n/a	3.46E-04	2.36E-02	1.81E-02	5.66E-02	58	4.2	58	3.1	12.7
05056000	305	29.2	1.76E-10	BET-	-1.51	n/a	8.87E-08	3.87E-02	1.60E-05	1.55E-01	61	10.8	61	0.3	4.1
05056100	218	29.0	> 0.05	BEV	no trend	0.23	> 0.05	n/a	2.28E-02	5.05E-02	24	97.8	24	0.0	0.5
05057200	296	29.3	4.00E-09	BET+	1.62	n/a	1.90E-05	9.25E-03	1.96E-06	1.24E-01	54	7.2	54	0.1	1.0
05059600	151	29.0	5.45E-06	BET+	1.06	n/a	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
05062500	244	22.3	> 0.05	BEV	no trend	0.39	3.30E-06	7.92E-02	7.54E-03	1.53E-01	61	6.4	61	2.4	17.6
05123400	143	27.5	4.84E-05	BET-	-1.95	n/a	> 0.05	n/a	> 0.05	n/a	54	41.7	51	0.0	2.2
05129115	234	31.8	> 0.05	BEV	no trend	0.21	> 0.05	n/a	> 0.05	n/a	31	3.1	31	10.8	43.0
05132000	350	46.9	> 0.05	BEV	no trend	0.20	> 0.05	n/a	> 0.05	n/a	61	4.5	61	12.2	53.5
05212700	76	21.2	> 0.05	BEV	no trend	0.16	4.21E-02	-2.62E-02	> 0.05	n/a	43	4.9	43	3.0	14.5

STAID	BE N msts	BE years	BE p	BE type	BET (cm/y)	BEV (m)	Q_{50}trend p	Q_{50}trend ($m^3/s/y$)	Q_{90}trend p	Q_{90}trend ($m^3/s/y$)	Q_{90}&Q_{50} years	Q_{90}/Q_{50}	Q_{90}/Q_{50} years	Q_{50} (m^3/s)	Q_{90} (m^3/s)
05291000	168	21.5	4.93E-09	BET-	-1.04	n/a	2.09E-05	1.32E-02	1.88E-02	8.52E-02	61	9.0	61	0.3	2.5
05293000	167	44.1	9.00E-20	BET-	-1.91	n/a	2.51E-03	1.52E-02	4.68E-02	8.23E-02	61	12.9	61	0.3	3.6
05311400	36	49.0	2.21E-03	BET-	-0.77	n/a	4.88E-02	1.81E-02	> 0.05	n/a	25	14.6	25	0.1	1.1
05317200	213	40.6	1.29E-02	BET+	0.22	n/a	> 0.05	n/a	> 0.05	n/a	35	5.3	35	0.9	4.5
05362000	146	22.2	2.91E-02	BET-	-0.44	n/a	> 0.05	n/a	> 0.05	n/a	61	7.0	61	5.0	31.9
05383950	58	10.3	4.88E-02	BET+	1.50	n/a	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
05384500	26	57.4	5.19E-03	BET-	-1.37	n/a	3.05E-02	1.38E-02	> 0.05	n/a	28	1.3	28	1.1	1.5
05385500	71	55.1	7.62E-15	BET-	-4.01	n/a	1.15E-03	5.73E-02	3.23E-03	1.02E-01	29	1.5	29	2.9	4.2
05387500	434	60.1	3.59E-80	BET-	-1.10	n/a	6.43E-05	8.04E-02	2.14E-04	3.37E-01	59	3.6	59	4.9	16.9
05389400	158	16.8	1.08E-04	BET-	-0.65	n/a	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
05393500	148	22.8	3.52E-03	BET-	-0.50	n/a	> 0.05	n/a	> 0.05	n/a	61	6.7	61	0.8	5.6
05399500	200	30.7	2.76E-02	BET-	-0.11	n/a	1.49E-02	7.61E-03	> 0.05	n/a	61	12.2	61	0.8	8.8
05408000	179	22.5	> 0.05	BEV	no trend	0.11	6.57E-07	2.92E-02	> 0.05	n/a	61	1.8	61	3.9	7.1
05411850	75	10.8	5.16E-04	BET-	-1.99	n/a	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
05412400	94	53.9	1.51E-02	BET-	-0.21	n/a	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
05412500	792	61.5	1.57E-113	BET+	0.95	n/a	2.49E-03	1.90E-01	2.42E-02	6.01E-01	61	3.5	61	17.1	62.3
05413500	202	23.3	2.52E-07	BET-	-1.03	n/a	4.46E-06	5.10E-02	4.49E-02	5.68E-02	61	1.7	61	3.5	6.5
05414000	182	22.9	> 0.05	BEV	no trend	0.14	7.47E-04	2.16E-02	> 0.05	n/a	61	1.8	61	2.1	3.9
05420680	98	15.7	> 0.05	BEV	no trend	0.23	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
05444000	220	30.9	4.60E-12	BET-	-0.23	n/a	8.07E-05	2.66E-02	5.05E-03	4.88E-02	61	2.2	61	1.9	4.6
05451210	139	14.7	1.87E-02	BET-	-0.51	n/a	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
05454000	650	59.5	6.74E-21	BET+	0.22	n/a	3.59E-03	3.93E-03	1.66E-02	1.18E-02	61	5.3	61	0.2	1.0
05458000	559	57.1	1.42E-18	BET-	-0.18	n/a	1.41E-03	3.18E-02	4.21E-04	1.68E-01	56	4.6	56	2.1	10.2
05464220	95	14.7	> 0.05	BEV	no trend	0.08	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
05466500	242	31.1	1.67E-02	BET+	0.15	n/a	> 0.05	n/a	2.46E-02	2.41E-01	61	4.2	61	4.2	18.7
05473450	97	11.0	4.21E-03	BET-	-0.43	n/a	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
05488200	206	23.8	> 0.05	BEV	no trend	0.23	> 0.05	n/a	> 0.05	n/a	25	10.1	25	0.2	2.7
05489000	684	60.9	3.62E-14	BET+	0.24	n/a	> 0.05	n/a	> 0.05	n/a	61	9.6	61	1.1	9.8
05494300	320	57.4	2.03E-53	BET-	-0.62	n/a	> 0.05	n/a	> 0.05	n/a	53	13.3	53	0.2	2.7
05495500	563	61.9	1.83E-07	BET-	-0.14	n/a	2.63E-03	1.84E-02	2.40E-02	2.15E-01	61	14.5	61	0.8	10.2
05503800	172	25.4	4.36E-30	BET-	-2.56	n/a	> 0.05	n/a	> 0.05	n/a	31	25.3	31	0.1	2.3
05506100	99	14.1	> 0.05	BEV	no trend	0.17	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
05507600	161	25.2	1.29E-03	BET-	-0.25	n/a	> 0.05	n/a	> 0.05	n/a	31	23.2	31	0.1	1.9
05514500	464	61.4	3.86E-16	BET+	0.62	n/a	1.62E-02	4.19E-02	> 0.05	n/a	61	11.8	61	2.4	29.8
05525500	226	30.7	> 0.05	BEV	no trend	0.35	> 0.05	n/a	1.70E-02	1.97E-01	61	7.6	61	3.7	28.2
05556500	431	59.5	2.10E-54	BET-	-0.71	n/a	3.83E-02	2.20E-02	> 0.05	n/a	60	4.8	60	1.8	9.1
05584500	185	31.3	1.66E-05	BET+	0.96	n/a	> 0.05	n/a	> 0.05	n/a	61	7.1	61	3.6	26.0
05585000	209	31.2	> 0.05	BEV	no trend	0.55	> 0.05	n/a	> 0.05	n/a	61	7.9	61	7.1	58.7
05591550	161	27.7	3.17E-03	BET+	0.52	n/a	> 0.05	n/a	> 0.05	n/a	30	6.8	30	0.3	1.9
05592050	197	27.6	> 0.05	BEV	no trend	0.17	> 0.05	n/a	> 0.05	n/a	31	8.6	31	0.5	4.4
05592575	144	22.6	> 0.05	BEV	no trend	0.18	> 0.05	n/a	> 0.05	n/a	21	16.4	21	0.1	1.6
05593575	206	29.6	8.61E-05	BET-	-0.51	n/a	> 0.05	n/a	> 0.05	n/a	43	25.3	43	0.1	3.2
05593900	207	47.6	> 0.05	BEV	no trend	0.14	> 0.05	n/a	3.76E-02	3.65E-02	47	10.7	47	0.1	1.6
05595730	176	28.0	1.71E-02	BET+	0.34	n/a	> 0.05	n/a	> 0.05	n/a	31	27.3	31	0.2	3.5
06036905	133	24.9	> 0.05	BEV	no trend	0.32	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
06037500	166	25.0	1.65E-14	BET-	-0.58	n/a	> 0.05	n/a	> 0.05	n/a	60	1.8	60	12.1	22.2
06043500	240	32.8	> 0.05	BEV	no trend	0.09	> 0.05	n/a	> 0.05	n/a	61	5.0	61	12.2	58.5
06073500	172	14.9	9.31E-04	BET-	-0.94	n/a	1.72E-02	-1.03E-02	3.78E-02	-8.52E-02	61	7.7	61	1.8	15.3
06078500	46	39.8	> 0.05	BEV	no trend	0.29	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
06102500	102	13.1	> 0.05	BEV	no trend	0.12	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
06183800	68	21.3	> 0.05	BEV	no trend	0.28	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
06183850	68	23.1	4.33E-11	BET-	-1.11	n/a	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
06187915	133	12.9	> 0.05	BEV	no trend	0.10	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
06187950	196	19.7	1.55E-34	BET+	5.98	n/a	> 0.05	n/a	> 0.05	n/a	19	11.3	19	1.3	13.2
06190540	123	21.1	1.07E-04	BET+	0.36	n/a	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
06191000	229	27.7	3.62E-02	BET+	0.07	n/a	> 0.05	n/a	> 0.05	n/a	61	4.2	61	3.4	15.0
06191500	261	35.3	3.38E-11	BET+	0.71	n/a	> 0.05	n/a	> 0.05	n/a	61	6.5	61	39.4	265.0
06218500	362	59.3	5.14E-04	BET-	-0.07	n/a	> 0.05	n/a	> 0.05	n/a	61	5.2	61	2.3	11.9
06221400	252	50.3	> 0.05	BEV	no trend	0.32	> 0.05	n/a	> 0.05	n/a	53	14.7	53	0.8	12.7
06224000	266	60.1	> 0.05	BEV	no trend	0.11	> 0.05	n/a	> 0.05	n/a	61	12.3	61	2.0	25.8
06278300	205	27.6	> 0.05	BEV	no trend	0.15	> 0.05	n/a	3.52E-02	-1.59E-02	54	15.4	54	0.2	2.5
06289000	248	30.3	4.44E-40	BET+	0.84	n/a	> 0.05	n/a	> 0.05	n/a	61	4.0	61	2.3	9.9
06291500	214	26.6	1.97E-16	BET+	0.49	n/a	> 0.05	n/a	> 0.05	n/a	59	5.2	59	0.6	3.1
06299500	72	11.5	> 0.05	BEV	no trend	0.02	> 0.05	n/a	> 0.05	n/a	20	10.2	20	0.2	2.5
06301480	110	17.9	> 0.05	BEV	no trend	0.03	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
06332515	181	28.5	1.01E-37	BET+	2.23	n/a	> 0.05	n/a	9.10E-03	-2.34E-03	44	15.6	44	0.0	0.1
06336600	196	28.8	4.04E-03	BET+	0.65	n/a	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
06339100	243	29.1	1.03E-20	BET+	3.25	n/a	> 0.05	n/a	2.38E-02	-8.02E-03	43	12.2	43	0.0	0.5
06339500	270	28.6	1.22E-33	BET-	-1.80	n/a	> 0.05	n/a	> 0.05	n/a	60	11.5	60	0.2	2.7
06342450	151	27.6	2.88E-02	BET+	0.37	n/a	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
06344600	245	28.6	1.11E-27	BET+	2.96	n/a	> 0.05	n/a	> 0.05	n/a	46	10.7	46	0.0	0.4
06347000	92	12.2	> 0.05	BEV	no trend	0.17	> 0.05	n/a	> 0.05	n/a	24	11.9	24	0.0	0.4
06347500	148	20.4	> 0.05	BEV	no trend	0.29	> 0.05	n/a	> 0.05	n/a	19	16.7	19	0.1	0.8
06351200	81	14.2	> 0.05	BEV	no trend	0.24	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
06352000	238	28.5	6.49E-07	BET-	-0.20	n/a	4.00E-02	1.04E-03	> 0.05	n/a	60	8.1	60	0.1	0.8
06353000	215	27.6	1.82E-21	BET-	-1.24	n/a	> 0.05	n/a	> 0.05	n/a	48	20.6	48	0.2	4.3
06360500	224	55.0	2.15E-11	BET+	0.79	n/a	8.23E-04	2.01E-02	> 0.05	n/a	56	29.2	55	0.2	7.9
06392900	167	17.4	> 0.05	BEV	no trend	0.04	> 0.05	n/a	> 0.05	n/a	36	1.3	36	0.1	0.1
06402430	128	17.2	> 0.05	BEV	no trend	0.06	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
06422500	322	32.9	> 0.05	BEV	no trend	0.08	> 0.05	n/a	> 0.05	n/a	44	4.2	44	0.3	0.9
06424000	149	18.8	3.96E-06	BET-	-0.47	n/a	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
06430850	170	22.2	2.34E-02	BET-	-0.13	n/a	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
06431500	276	60.4	4.74E-11	BET-	-0.15	n/a	2.62E-07	1.52E-02	3.54E-03	1.73E-02	61	1.5	61	1.3	2.1
06440200	97	21.9	> 0.05	BEV	no trend	0.13	> 0.05	n/a	> 0.05	n/a	21	113.0	20	0.0	0.4
06441500	208	28.4	> 0.05	BEV	no trend	0.24	> 0.05	n/a	> 0.05	n/a	59	87.2	59	0.0	3.7
06445980	98	42.1	> 0.05	BEV	no trend	0.10	> 0.05	n/a	> 0.05	n/a	32	2.4	32	0.2	0.6
06446700	132	17.1	> 0.05	BEV	no trend	0.18	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
06447000	264	26.2	1.66E-42	BET-	-2.73	n/a	> 0.05	n/a	> 0.05	n/a	61	9.2	61	1.5	17.2
06447230	117	19.1	> 0.05	BEV	no trend	0.11	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
06447450	77	10.1	> 0.05	BEV	no trend	0.17	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.

STAID	BE N msts	BE years	BE p	BE type	BET (cm/y)	BEV (m)	Q_{50}trend p	Q_{50}trend ($m^3/s/y$)	Q_{90}trend p	Q_{90}trend ($m^3/s/y$)	Q_{90}&Q_{50} years	Q_{90}/Q_{50}	Q_{90}/Q_{50} years	Q_{50} (m^3/s)	Q_{90} (m^3/s)
06450500	254	43.1	1.89E-30	BET-	-1.20	n/a	1.58E-04	1.96E-02	> 0.05	n/a	59	2.2	59	2.7	6.2
06452000	302	29.4	1.21E-80	BET+	3.52	n/a	8.03E-03	6.87E-02	> 0.05	n/a	60	6.6	60	4.5	31.4
06453255	219	27.1	5.95E-15	BET+	1.06	n/a	> 0.05	n/a	> 0.05	n/a	18	10.7	18	0.1	2.6
06468170	229	28.1	> 0.05	BEV	no trend	0.27	1.46E-04	9.63E-03	2.04E-02	1.96E-01	41	29.6	41	0.1	1.9
06468250	253	25.9	2.11E-02	BET-	-0.03	n/a	6.45E-03	3.95E-02	> 0.05	n/a	25	17.4	25	0.2	5.2
06470800	151	27.4	1.14E-03	BET+	0.97	n/a	2.82E-09	6.84E-03	2.37E-04	1.19E-01	34	39.1	33	0.0	0.8
06471200	162	43.4	8.79E-05	BET-	-0.26	n/a	2.54E-04	3.21E-03	9.32E-04	7.71E-02	54	33.7	51	0.0	1.0
06474000	83	25.5	> 0.05	BEV	no trend	0.27	> 0.05	n/a	> 0.05	n/a	34	38.6	34	0.0	0.2
06476500	55	13.1	1.91E-02	BET-	-4.52	n/a	> 0.05	n/a	> 0.05	n/a	37	41.7	36	0.0	0.2
06477500	271	36.4	7.36E-05	BET-	-0.19	n/a	5.09E-07	2.48E-03	3.57E-03	6.14E-02	55	55.0	55	0.0	0.4
06478540	162	26.4	1.81E-02	BET+	0.63	n/a	5.40E-04	5.71E-04	5.87E-04	2.17E-02	40	58.5	24	0.0	0.1
06479215	247	27.1	1.27E-14	BET-	-0.66	n/a	> 0.05	n/a	> 0.05	n/a	26	17.1	26	0.0	0.9
06479438	259	27.8	> 0.05	BEV	no trend	0.12	6.26E-04	1.43E-02	4.17E-03	1.10E-01	38	10.5	38	0.2	1.6
06479500	444	61.4	1.44E-02	BET-	-0.44	n/a	8.67E-03	1.12E-02	> 0.05	n/a	61	18.0	61	0.1	1.5
06614800	202	26.0	5.94E-14	BET+	0.61	n/a	> 0.05	n/a	> 0.05	n/a	36	14.5	36	0.0	0.3
06623800	248	28.0	2.43E-02	BET-	-0.19	n/a	> 0.05	n/a	> 0.05	n/a	46	15.1	46	0.8	11.5
06632400	297	28.1	1.14E-05	BET-	-0.24	n/a	> 0.05	n/a	> 0.05	n/a	56	18.4	56	0.4	7.3
06821080	66	12.5	> 0.05	BEV	no trend	0.14	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
06846500	47	22.4	> 0.05	BEV	no trend	0.10	1.71E-04	-3.39E-03	3.50E-08	-3.28E-02	61	5.3	49	0.0	0.1
06847900	97	23.9	> 0.05	BEV	no trend	0.10	> 0.05	n/a	> 0.05	n/a	48	3.6	48	0.0	0.2
06853800	160	23.8	5.88E-24	BET-	-1.35	n/a	> 0.05	n/a	> 0.05	n/a	53	5.3	53	0.2	0.7
06869950	70	19.3	> 0.05	BEV	no trend	0.17	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
06870300	77	51.9	2.33E-12	BET-	-7.17	n/a	> 0.05	n/a	> 0.05	n/a	51	4.2	51	0.2	0.8
06876700	166	23.9	1.30E-02	BET+	0.41	n/a	4.86E-02	5.84E-03	> 0.05	n/a	51	6.3	51	0.3	1.8
06878000	211	57.2	> 0.05	BEV	no trend	0.18	2.49E-02	7.77E-03	> 0.05	n/a	57	3.5	57	0.6	2.6
06879650	112	20.6	9.68E-03	BET+	0.22	n/a	> 0.05	n/a	> 0.05	n/a	31	7.8	28	0.0	0.1
06885500	184	23.6	1.71E-02	BET-	-0.69	n/a	3.00E-02	1.34E-02	> 0.05	n/a	57	6.4	57	0.8	4.8
06889160	109	13.5	9.16E-04	BET-	-0.67	n/a	> 0.05	n/a	> 0.05	n/a	35	6.9	35	0.1	0.9
06897950	110	26.5	1.83E-05	BET+	2.07	n/a	> 0.05	n/a	> 0.05	n/a	25	9.9	25	0.1	1.4
06899700	373	54.3	2.08E-11	BET+	0.72	n/a	> 0.05	n/a	> 0.05	n/a	53	11.3	53	1.6	14.7
06903400	457	45.6	8.36E-58	BET-	-2.04	n/a	> 0.05	n/a	> 0.05	n/a	45	20.6	45	0.3	7.2
06906150	110	13.7	3.70E-06	BET-	-0.96	n/a	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
06906800	178	23.7	6.07E-11	BET-	-2.88	n/a	> 0.05	n/a	> 0.05	n/a	23	9.5	23	2.0	20.1
06910800	162	41.9	> 0.05	BEV	no trend	0.11	> 0.05	n/a	> 0.05	n/a	41	10.8	41	0.4	4.8
06917380	159	21.0	> 0.05	BEV	no trend	0.11	> 0.05	n/a	> 0.05	n/a	35	11.7	35	1.1	12.1
06918460	198	27.2	3.46E-20	BET-	-1.65	n/a	> 0.05	n/a	> 0.05	n/a	45	4.3	45	3.5	15.1
06919500	307	61.1	4.25E-11	BET+	0.74	n/a	> 0.05	n/a	> 0.05	n/a	61	9.2	61	2.0	17.6
06921070	189	24.5	1.12E-06	BET-	-0.66	n/a	> 0.05	n/a	> 0.05	n/a	42	5.8	42	2.6	15.0
06928300	79	11.1	> 0.05	BEV	no trend	0.12	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
06930000	293	60.3	> 0.05	BEV	no trend	0.12	> 0.05	n/a	> 0.05	n/a	61	3.5	61	7.0	25.7
07014000	97	61.0	9.12E-17	BET-	-4.17	n/a	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
07014500	443	61.9	6.31E-06	BET-	-0.76	n/a	5.58E-03	1.23E-01	4.08E-02	4.11E-01	61	3.4	61	17.5	61.4
07030392	104	15.9	2.80E-11	BET-	-5.80	n/a	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
07030500	61	10.1	1.63E-06	BET-	-4.36	n/a	> 0.05	n/a	> 0.05	n/a	59	3.8	59	8.6	31.9
07048800	72	11.7	2.62E-02	BET+	1.52	n/a	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
07053250	115	15.5	1.90E-03	BET+	1.10	n/a	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
07053810	108	17.7	> 0.05	BEV	no trend	0.19	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
07054080	124	17.6	9.71E-16	BET-	-4.05	n/a	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
07055646	82	17.5	1.29E-03	BET-	-1.17	n/a	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
07055875	82	15.7	> 0.05	BEV	no trend	0.23	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
07057500	357	59.6	2.00E-22	BET-	-0.26	n/a	> 0.05	n/a	> 0.05	n/a	61	2.3	61	14.2	34.0
07058000	392	61.3	1.51E-24	BET+	0.80	n/a	> 0.05	n/a	> 0.05	n/a	61	3.0	61	7.2	22.6
07060710	348	45.0	8.61E-21	BET-	-0.36	n/a	> 0.05	n/a	> 0.05	n/a	45	6.5	45	0.3	2.2
07064533	61	10.2	1.27E-02	BET-	-2.49	n/a	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
07067000	301	60.8	1.29E-24	BET-	-0.88	n/a	1.58E-02	1.75E-01	> 0.05	n/a	61	2.5	61	35.5	94.9
07071500	323	60.5	9.54E-14	BET-	-0.33	n/a	> 0.05	n/a	> 0.05	n/a	61	2.1	61	16.7	35.6
07072000	447	61.4	6.27E-03	BET-	-0.39	n/a	> 0.05	n/a	> 0.05	n/a	59	2.2	59	24.3	51.7
07075300	375	50.4	6.58E-08	BET-	-1.47	n/a	> 0.05	n/a	> 0.05	n/a	47	5.8	47	2.2	14.0
07083000	225	23.9	7.48E-07	BET-	-0.21	n/a	> 0.05	n/a	> 0.05	n/a	61	9.2	61	0.3	2.5
07142300	161	21.6	9.90E-34	BET+	1.71	n/a	1.67E-05	-1.21E-02	7.93E-03	-1.67E-02	51	1.9	51	0.3	0.7
07145700	176	22.4	> 0.05	BEV	no trend	0.07	1.10E-02	6.16E-03	> 0.05	n/a	41	7.8	41	0.2	2.2
07148400	165	29.3	2.54E-10	BET-	-0.47	n/a	4.36E-02	4.69E-02	> 0.05	n/a	49	3.8	49	1.4	6.7
07149000	175	22.7	2.08E-51	BET-	-1.52	n/a	2.37E-03	2.47E-02	> 0.05	n/a	51	2.4	51	2.5	5.8
07151500	176	23.5	> 0.05	BEV	no trend	0.08	1.01E-03	3.70E-02	> 0.05	n/a	60	3.7	60	2.8	12.1
07167500	175	22.2	4.30E-14	BET-	-1.53	n/a	> 0.05	n/a	3.09E-02	3.79E-02	61	9.9	61	0.3	3.1
07180500	156	21.0	4.77E-02	BET-	-0.11	n/a	> 0.05	n/a	2.76E-02	2.40E-02	61	3.9	61	0.5	2.0
07184000	164	23.9	> 0.05	BEV	no trend	0.09	> 0.05	n/a	> 0.05	n/a	51	20.0	51	0.4	6.1
07188653	69	11.0	1.11E-02	BET+	0.43	n/a	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
07189100	75	11.0	> 0.05	BEV	no trend	0.12	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
07191222	79	17.4	1.06E-11	BET+	3.54	n/a	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
07195800	414	47.3	> 0.05	BEV	no trend	0.14	> 0.05	n/a	> 0.05	n/a	49	3.0	49	0.2	0.7
07196900	430	51.5	1.35E-05	BET-	-0.08	n/a	> 0.05	n/a	> 0.05	n/a	52	6.1	52	0.4	2.3
07197000	160	25.1	> 0.05	BEV	no trend	0.19	1.13E-02	3.68E-02	4.34E-02	9.72E-02	61	4.6	61	3.9	17.2
07208500	230	23.7	5.73E-13	BET-	-0.37	n/a	2.69E-02	8.98E-04	> 0.05	n/a	61	4.6	61	0.2	0.8
07226500	48	23.2	1.52E-06	BET-	-0.86	n/a	> 0.05	n/a	1.07E-02	-1.12E-02	61	59.2	47	0.0	0.1
07247250	98	20.0	> 0.05	BEV	no trend	0.12	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
07252000	101	25.4	> 0.05	BEV	no trend	0.22	> 0.05	n/a	> 0.05	n/a	61	6.5	61	5.3	32.8
07257006	106	19.1	> 0.05	BEV	no trend	0.14	> 0.05	n/a	> 0.05	n/a	18	7.0	18	4.0	30.5
07260000	374	61.5	1.85E-34	BET+	0.23	n/a	> 0.05	n/a	> 0.05	n/a	60	10.8	60	0.4	4.5
07261000	465	56.2	> 0.05	BEV	no trend	0.15	> 0.05	n/a	> 0.05	n/a	56	7.0	56	2.4	16.7
07263295	98	20.9	> 0.05	BEV	no trend	0.18	> 0.05	n/a	> 0.05	n/a	21	12.7	21	0.3	4.0
07290650	230	26.7	3.29E-15	BET-	-1.89	n/a	> 0.05	n/a	> 0.05	n/a	46	7.9	46	6.0	46.3
07295000	176	20.3	1.23E-03	BET-	-0.69	n/a	> 0.05	n/a	> 0.05	n/a	58	5.1	58	2.4	13.0
07299670	179	27.0	5.75E-07	BET+	1.09	n/a	2.38E-11	9.04E-03	1.61E-09	1.55E-02	49	1.7	49	0.2	0.4
07301410	173	24.6	> 0.05	BEV	no trend	0.15	> 0.05	n/a	> 0.05	n/a	49	2.2	49	0.3	0.6
07301500	157	49.4	1.16E-40	BET-	-1.99	n/a	1.05E-04	2.89E-02	> 0.05	n/a	61	3.5	60	1.4	5.8
07311600	115	17.0	2.05E-02	BET-	-0.29	n/a	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
07311630	107	17.5	> 0.05	BEV	no trend	0.13	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
07311900	107	15.0	4.57E-03	BET+	0.65	n/a	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
07315200	117	23.8	1.47E-08	BET-	-1.34	n/a	> 0.05	n/a	> 0.05	n/a	47	88.3	44	0.0	0.2

STAID	BE N msts	BE years	BE p	BE type	BET (cm/y)	BEV (m)	Q_{50}trend p	Q_{50}trend ($m^3/s/y$)	Q_{90}trend p	Q_{90}trend ($m^3/s/y$)	Q_{90}&Q_{50} years	Q_{90}/Q_{50}	Q_{90}/Q_{50} years	Q_{50} (m^3/s)	Q_{90} (m^3/s)
07315700	153	27.6	2.71E-08	BET-	-1.17	n/a	> 0.05	n/a	> 0.05	n/a	50	25.9	50	0.2	4.5
07335700	136	27.9	> 0.05	BEV	no trend	0.13	> 0.05	n/a	> 0.05	n/a	45	6.8	45	0.8	4.8
07340300	333	43.7	2.06E-04	BET+	0.15	n/a	> 0.05	n/a	> 0.05	n/a	43	5.9	43	1.7	10.1
07342480	90	19.3	5.65E-13	BET-	-9.91	n/a	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
07346045	134	24.2	1.40E-02	BET-	-2.41	n/a	> 0.05	n/a	> 0.05	n/a	42	4.8	42	4.0	22.4
07352800	152	26.6	2.58E-05	BET+	0.52	n/a	> 0.05	n/a	> 0.05	n/a	38	29.6	38	0.1	7.3
07359610	131	23.3	> 0.05	BEV	no trend	0.15	> 0.05	n/a	> 0.05	n/a	22	4.1	22	3.1	13.0
07360200	99	22.8	> 0.05	BEV	no trend	0.10	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
07362500	261	59.9	1.06E-03	BET-	-0.31	n/a	2.17E-02	2.07E-02	> 0.05	n/a	59	30.2	59	0.5	17.4
07362587	93	20.1	> 0.05	BEV	no trend	0.10	> 0.05	n/a	> 0.05	n/a	20	13.0	20	0.2	2.8
07375000	125	34.1	4.88E-11	BET-	-1.12	n/a	> 0.05	n/a	> 0.05	n/a	61	3.6	61	1.9	7.2
07376000	196	59.4	3.87E-03	BET-	-0.98	n/a	> 0.05	n/a	> 0.05	n/a	60	4.4	60	4.6	20.3
07377000	187	45.6	4.46E-05	BET-	-0.98	n/a	> 0.05	n/a	> 0.05	n/a	60	3.6	60	11.8	41.9
08013000	91	24.0	> 0.05	BEV	no trend	0.22	> 0.05	n/a	> 0.05	n/a	61	10.9	61	4.5	51.6
08014500	130	25.5	3.69E-02	BET-	-0.34	n/a	> 0.05	n/a	> 0.05	n/a	59	4.4	59	9.7	44.4
08023080	122	28.4	> 0.05	BEV	no trend	0.19	> 0.05	n/a	> 0.05	n/a	30	35.6	29	0.1	4.3
08023400	126	31.4	6.80E-03	BET+	0.13	n/a	> 0.05	n/a	> 0.05	n/a	33	19.3	32	0.2	4.1
08029500	375	59.5	> 0.05	BEV	no trend	0.15	2.66E-02	9.81E-03	4.86E-02	4.50E-02	58	3.1	58	1.8	5.7
08050800	99	24.4	9.05E-04	BET-	-0.58	n/a	3.05E-05	-3.45E-03	3.37E-03	-3.10E-02	25	14.2	24	0.0	0.5
08050840	46	15.5	> 0.05	BEV	no trend	0.11	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
08066200	377	48.5	1.54E-67	BET-	-1.24	n/a	> 0.05	n/a	> 0.05	n/a	48	11.0	48	0.4	3.9
08066300	311	45.3	9.02E-13	BET+	0.43	n/a	> 0.05	n/a	> 0.05	n/a	45	4.7	45	1.3	6.5
08070200	165	26.2	7.97E-24	BET-	-2.67	n/a	> 0.05	n/a	> 0.05	n/a	26	8.0	26	2.5	16.7
08079600	195	48.9	3.86E-28	BET+	1.03	n/a	> 0.05	n/a	> 0.05	n/a	49	142.9	48	0.0	0.3
08082700	58	23.7	> 0.05	BEV	no trend	0.08	> 0.05	n/a	> 0.05	n/a	47	95.7	33	0.0	0.0
08095300	103	45.6	2.60E-04	BET-	-0.24	n/a	> 0.05	n/a	> 0.05	n/a	51	7.5	50	0.4	3.7
08099300	101	22.3	2.37E-08	BET-	-1.39	n/a	2.64E-02	-4.30E-04	> 0.05	n/a	50	11.3	50	0.0	0.4
08101000	274	60.6	5.15E-11	BET+	0.48	n/a	> 0.05	n/a	> 0.05	n/a	60	11.7	60	0.2	2.6
08103900	110	47.8	> 0.05	BEV	no trend	0.06	> 0.05	n/a	> 0.05	n/a	47	9.9	46	0.0	0.6
08104900	371	43.7	6.85E-22	BET+	0.54	n/a	> 0.05	n/a	> 0.05	n/a	43	5.7	43	0.5	2.4
08109700	204	49.3	1.41E-04	BET-	-0.73	n/a	5.08E-03	6.49E-03	> 0.05	n/a	48	11.0	46	0.2	1.8
08128400	256	47.0	3.44E-07	BET+	0.22	n/a	> 0.05	n/a	> 0.05	n/a	49	3.1	37	0.0	0.2
08152900	222	32.1	1.04E-03	BET+	0.35	n/a	> 0.05	n/a	> 0.05	n/a	31	3.1	31	0.6	1.5
08155200	204	33.5	> 0.05	BEV	no trend	0.15	> 0.05	n/a	> 0.05	n/a	32	7.9	32	0.2	2.5
08158700	263	36.6	7.79E-13	BET+	1.04	n/a	> 0.05	n/a	> 0.05	n/a	31	5.5	30	0.3	2.6
08158810	198	33.8	2.00E-02	BET-	-0.14	n/a	> 0.05	n/a	> 0.05	n/a	31	7.2	30	0.0	0.3
08164000	489	60.3	5.96E-90	BET+	1.09	n/a	> 0.05	n/a	> 0.05	n/a	61	6.9	61	1.9	10.7
08164300	383	49.3	2.72E-43	BET+	0.65	n/a	> 0.05	n/a	> 0.05	n/a	49	4.8	49	0.7	3.0
08164600	308	41.7	6.18E-47	BET-	-1.60	n/a	> 0.05	n/a	> 0.05	n/a	40	17.2	39	0.1	1.4
08166000	315	61.8	8.52E-109	BET-	-0.99	n/a	2.40E-09	9.72E-03	1.67E-07	1.82E-02	61	1.7	61	0.5	0.8
08171300	208	51.1	> 0.05	BEV	no trend	0.15	> 0.05	n/a	> 0.05	n/a	53	3.8	53	2.1	7.5
08175000	356	51.0	2.07E-35	BET+	0.92	n/a	> 0.05	n/a	> 0.05	n/a	51	12.6	51	0.3	3.5
08176900	243	30.1	3.72E-09	BET-	-0.56	n/a	> 0.05	n/a	> 0.05	n/a	31	4.9	31	0.3	1.8
08177300	152	32.0	> 0.05	BEV	no trend	0.15	9.18E-03	-2.59E-04	> 0.05	n/a	32	4.8	31	0.0	0.0
08178880	195	27.5	1.12E-03	BET-	-0.33	n/a	> 0.05	n/a	> 0.05	n/a	27	2.6	27	1.9	4.5
08186500	204	48.8	6.40E-19	BET-	-0.76	n/a	> 0.05	n/a	> 0.05	n/a	48	24.6	45	0.0	0.3
08189500	132	24.6	3.24E-04	BET-	-0.51	n/a	8.95E-03	6.54E-03	> 0.05	n/a	61	6.3	61	0.4	2.3
08190000	165	51.2	> 0.05	BEV	no trend	0.29	> 0.05	n/a	> 0.05	n/a	61	2.2	61	2.4	5.7
08190500	175	51.0	7.12E-09	BET-	-0.87	n/a	7.39E-04	1.48E-03	> 0.05	n/a	54	11.2	52	0.0	0.2
08194200	192	45.5	5.08E-03	BET-	-0.78	n/a	> 0.05	n/a	> 0.05	n/a	49	200.0	40	0.0	0.2
08195000	482	55.8	6.64E-04	BET+	0.14	n/a	> 0.05	n/a	> 0.05	n/a	61	2.0	61	2.1	4.7
08196000	510	55.5	1.22E-10	BET-	-0.23	n/a	> 0.05	n/a	> 0.05	n/a	58	2.8	58	0.4	1.5
08200000	472	55.5	3.84E-12	BET-	-0.27	n/a	> 0.05	n/a	> 0.05	n/a	58	3.8	58	0.4	1.6
08201500	293	47.0	8.20E-05	BET-	-0.09	n/a	> 0.05	n/a	> 0.05	n/a	49	4.1	48	0.2	0.7
08202700	56	43.2	2.15E-06	BET+	0.84	n/a	i.d.	i.d.	> 0.05	n/a	50	0.0	0.0	0.0	0.0
08210400	21	35.9	> 0.05	BEV	no trend	0.13	i.d.	i.d.	> 0.05	n/a	38	0.0	0.0	0.0	0.0
08253500	134	23.3	1.61E-03	BET+	0.25	n/a	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
08267500	244	25.0	2.51E-25	BET-	-0.88	n/a	> 0.05	n/a	> 0.05	n/a	61	4.4	61	0.5	2.2
08269000	222	45.6	> 0.05	BEV	no trend	0.06	> 0.05	n/a	> 0.05	n/a	61	5.7	61	0.3	1.8
08271000	234	45.6	7.24E-35	BET+	0.87	n/a	> 0.05	n/a	> 0.05	n/a	61	4.0	61	0.3	1.5
08277470	159	16.8	7.99E-09	BET-	-0.71	n/a	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
08315480	49	12.7	2.20E-03	BET+	0.62	n/a	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
08324000	301	48.8	6.86E-07	BET+	1.15	n/a	> 0.05	n/a	> 0.05	n/a	57	5.4	57	0.9	5.0
08340500	53	44.9	> 0.05	BEV	no trend	0.15	1.88E-04	1.03E-03	> 0.05	n/a	60	116.7	53	0.0	0.4
08377900	215	26.3	> 0.05	BEV	no trend	0.10	> 0.05	n/a	> 0.05	n/a	45	4.9	45	0.4	2.4
08378500	265	28.1	2.60E-08	BET-	-0.43	n/a	2.06E-02	8.15E-03	> 0.05	n/a	60	4.3	60	1.3	7.1
08380500	236	24.0	1.45E-05	BET+	0.48	n/a	3.18E-03	2.62E-03	> 0.05	n/a	61	4.6	61	0.2	1.1
08386505	123	11.9	6.79E-06	BET-	-0.79	n/a	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
09034900	156	45.0	> 0.05	BEV	no trend	0.08	1.23E-02	4.82E-04	> 0.05	n/a	44	15.7	44	0.1	0.9
09035900	156	21.9	3.27E-05	BET-	-0.16	n/a	1.91E-02	1.91E-03	> 0.05	n/a	44	7.6	44	0.4	2.7
09047700	186	31.4	6.51E-06	BET+	0.23	n/a	1.55E-02	3.32E-04	> 0.05	n/a	52	4.7	52	0.1	0.4
09063400	175	22.3	3.83E-42	BET+	0.91	n/a	> 0.05	n/a	> 0.05	n/a	43	11.2	43	0.2	1.9
09066000	181	32.8	1.42E-02	BET-	-0.20	n/a	1.14E-03	6.45E-04	> 0.05	n/a	60	13.8	60	0.1	1.5
09066100	175	30.3	1.80E-04	BET-	-0.24	n/a	> 0.05	n/a	> 0.05	n/a	43	12.5	43	0.1	0.9
09066150	183	24.0	6.94E-07	BET-	-0.22	n/a	1.14E-02	6.95E-04	> 0.05	n/a	40	10.7	40	0.1	1.0
09066200	203	26.4	> 0.05	BEV	no trend	0.08	> 0.05	n/a	> 0.05	n/a	45	18.8	45	0.1	1.1
09066300	192	25.9	5.38E-10	BET+	0.70	n/a	> 0.05	n/a	> 0.05	n/a	45	20.6	45	0.0	0.5
09066400	196	24.1	3.91E-07	BET+	0.31	n/a	> 0.05	n/a	> 0.05	n/a	43	14.8	43	0.1	0.8
09081600	245	52.2	6.67E-32	BET-	-0.90	n/a	> 0.05	n/a	> 0.05	n/a	55	10.0	55	2.5	26.7
09107000	171	23.6	> 0.05	BEV	no trend	0.06	> 0.05	n/a	> 0.05	n/a	22	4.6	22	1.5	6.5
09196500	216	29.6	3.14E-10	BET-	-0.58	n/a	> 0.05	n/a	> 0.05	n/a	56	14.5	56	1.1	14.7
09210500	254	27.0	> 0.05	BEV	no trend	0.12	> 0.05	n/a	> 0.05	n/a	59	5.5	59	0.9	4.9
09223000	266	29.1	8.29E-13	BET-	-1.30	n/a	> 0.05	n/a	> 0.05	n/a	57	13.5	57	0.6	8.6
09306242	251	27.3	6.51E-25	BET-	-0.96	n/a	2.26E-03	-8.97E-04	> 0.05	n/a	35	2.5	35	0.0	0.0
09312600	195	24.9	1.78E-20	BET+	0.86	n/a	2.48E-02	-1.38E-03	> 0.05	n/a	43	15.1	43	0.2	2.6
09329050	106	18.0	2.65E-04	BET-	-0.41	n/a	> 0.05	n/a	> 0.05	n/a	46	3.2	46	0.2	0.8
09352900	172	27.1	1.76E-02	BET+	0.18	n/a	> 0.05	n/a	> 0.05	n/a	48	5.8	48	1.7	11.3
09378170	169	22.5	1.62E-06	BET+	0.23	n/a	4.39E-03	-3.08E-04	> 0.05	n/a	24	16.8	24	0.0	0.1
09378630	68	27.1	2.04E-03	BET+	0.16	n/a	2.02E-03	-3.90E-05	> 0.05	n/a	45	70.0	45	0.0	0.1
09386900	104	23.4	2.37E-15	BET+	2.69	n/a	3.23E-02	-1.22E-04	> 0.05	n/a	39	15.4	34	0.0	0.1

STAID	BE N msts	BE years	BE p	BE type	BET (cm/y)	BEV (m)	Q_{50}trend p	Q_{50}trend (m^3/s/y)	Q_{90}trend p	Q_{90}trend (m^3/s/y)	Q_{90}&Q_{50} years	Q_{90}/Q_{50}	Q_{90}/Q_{50} years	Q_{50} (m^3/s)	Q_{90} (m^3/s)
09404115	89	17.8	2.60E-06	BET-	-0.87	n/a	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
09404208	215	15.4	7.02E-13	BET+	1.84	n/a	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
09404222	55	10.2	2.25E-17	BET+	7.88	n/a	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
09404343	121	15.7	4.53E-25	BET-	-7.06	n/a	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
09404450	262	29.8	2.70E-02	BET-	-0.07	n/a	1.44E-03	-4.20E-03	> 0.05	n/a	44	1.7	44	0.4	0.6
09408195	29	27.3	4.75E-04	BET-	-0.48	n/a	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
09415515	108	24.6	> 0.05	BEV	no trend	0.06	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
09423350	20	16.9	1.08E-08	BET-	-1.73	n/a	i.d.	i.d.	> 0.05	n/a	47	0.0	0.0	0.0	0.0
09444200	235	24.7	> 0.05	BEV	no trend	0.22	> 0.05	n/a	> 0.05	n/a	43	5.7	43	0.5	3.0
09447800	260	27.4	2.31E-81	BET+	3.99	n/a	1.06E-03	-2.74E-03	2.05E-03	-8.87E-03	29	1.7	29	0.1	0.2
09470800	94	15.3	> 0.05	BEV	no trend	0.13	> 0.05	n/a	> 0.05	n/a	51	10.2	51	0.0	0.1
09480000	228	26.8	> 0.05	BEV	no trend	0.46	> 0.05	n/a	> 0.05	n/a	61	3.5	61	0.0	0.0
09484000	89	19.1	3.13E-06	BET+	1.18	n/a	> 0.05	n/a	> 0.05	n/a	61	28.3	61	0.0	0.7
09484600	259	19.3	2.87E-04	BET+	0.32	n/a	1.32E-08	-6.22E-04	> 0.05	n/a	52	3.2	52	0.0	0.1
09487000	37	15.0	> 0.05	BEV	no trend	0.18	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
09492400	155	24.9	9.68E-11	BET-	-0.45	n/a	> 0.05	n/a	> 0.05	n/a	53	4.4	53	0.5	2.3
09494000	164	24.9	> 0.05	BEV	no trend	0.20	> 0.05	n/a	> 0.05	n/a	53	5.0	53	2.1	11.9
09497800	170	25.1	1.73E-24	BET-	-0.98	n/a	> 0.05	n/a	> 0.05	n/a	51	3.3	51	0.5	1.7
09497980	156	27.6	1.22E-06	BET-	-0.31	n/a	3.28E-03	-2.44E-03	> 0.05	n/a	45	4.6	45	0.2	1.0
09505200	193	21.6	6.61E-20	BET-	-1.25	n/a	1.89E-02	-3.08E-04	> 0.05	n/a	49	5.7	49	0.2	1.2
09505350	102	25.1	> 0.05	BEV	no trend	0.12	> 0.05	n/a	> 0.05	n/a	50	608.1	18	0.0	1.4
09505800	269	44.3	1.84E-63	BET-	-4.38	n/a	> 0.05	n/a	> 0.05	n/a	46	4.2	46	0.5	2.0
09508300	190	26.5	2.83E-04	BET+	0.27	n/a	> 0.05	n/a	> 0.05	n/a	43	37.9	43	0.0	0.4
09510200	139	25.5	4.03E-14	BET-	-0.50	n/a	> 0.05	n/a	> 0.05	n/a	50	33.2	48	0.0	0.5
09513780	113	26.9	8.69E-11	BET-	-0.91	n/a	> 0.05	n/a	> 0.05	n/a	45	40.6	28	0.0	0.1
09535100	37	26.5	> 0.05	BEV	no trend	0.09	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
09537200	209	24.9	2.17E-22	BET-	-0.42	n/a	2.70E-04	-3.37E-04	3.64E-03	-5.50E-04	41	2.0	39	0.0	0.0
10172200	219	25.0	4.70E-02	BET+	0.11	n/a	> 0.05	n/a	> 0.05	n/a	47	4.1	47	0.1	0.3
10172700	205	24.9	1.08E-02	BET+	0.09	n/a	1.44E-03	9.00E-04	1.81E-02	1.44E-03	52	1.4	52	0.1	0.1
10172800	228	26.7	8.86E-24	BET+	0.47	n/a	> 0.05	n/a	> 0.05	n/a	46	4.0	46	0.1	0.4
10173450	203	28.0	> 0.05	BEV	no trend	0.12	> 0.05	n/a	> 0.05	n/a	46	5.6	46	0.5	3.0
10205030	201	28.0	6.56E-22	BET+	0.52	n/a	> 0.05	n/a	> 0.05	n/a	47	3.3	47	0.3	0.9
10242000	276	27.9	9.30E-12	BET+	1.41	n/a	> 0.05	n/a	> 0.05	n/a	60	5.6	60	0.3	2.1
10243260	120	22.8	2.87E-20	BET-	-0.75	n/a	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
10244950	180	25.6	> 0.05	BEV	no trend	0.02	> 0.05	n/a	> 0.05	n/a	44	2.0	44	0.1	0.3
10249300	431	46.2	> 0.05	BEV	no trend	0.10	> 0.05	n/a	> 0.05	n/a	44	5.0	44	0.1	0.4
10257600	126	17.6	> 0.05	BEV	no trend	0.03	> 0.05	n/a	> 0.05	n/a	43	2.9	42	0.0	0.1
10258000	140	22.4	4.27E-03	BET+	0.38	n/a	> 0.05	n/a	> 0.05	n/a	59	7.4	59	0.0	0.1
10258500	133	27.0	1.03E-09	BET-	-1.15	n/a	> 0.05	n/a	> 0.05	n/a	61	22.1	53	0.0	0.0
10259000	262	21.3	2.01E-16	BET-	-0.33	n/a	> 0.05	n/a	> 0.05	n/a	61	2.1	61	0.0	0.1
10259200	70	30.1	> 0.05	BEV	no trend	0.28	> 0.05	n/a	> 0.05	n/a	47	15.7	44	0.0	0.0
10263500	237	28.6	5.24E-08	BET-	-0.44	n/a	> 0.05	n/a	> 0.05	n/a	59	2.7	59	0.2	0.4
10291500	366	58.1	3.07E-05	BET+	0.05	n/a	> 0.05	n/a	> 0.05	n/a	56	6.2	56	0.7	4.4
10308200	222	26.4	9.32E-03	BET-	-0.32	n/a	> 0.05	n/a	> 0.05	n/a	50	6.6	50	3.7	27.5
10308783	108	12.5	> 0.05	BEV	no trend	0.04	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
10310500	254	23.1	1.04E-03	BET-	-0.08	n/a	> 0.05	n/a	> 0.05	n/a	61	1.9	61	0.1	0.2
10313400	128	16.7	> 0.05	BEV	no trend	0.26	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
10316500	215	34.9	3.78E-17	BET-	-1.41	n/a	> 0.05	n/a	> 0.05	n/a	60	21.1	60	0.2	4.5
10321590	125	19.6	6.97E-06	BET-	-0.53	n/a	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
10329500	161	20.3	5.76E-09	BET+	0.35	n/a	> 0.05	n/a	> 0.05	n/a	61	8.3	61	0.3	2.8
10336645	305	28.7	1.13E-12	BET+	0.36	n/a	> 0.05	n/a	> 0.05	n/a	30	11.6	30	0.1	1.4
10336660	319	36.5	7.20E-13	BET+	0.54	n/a	> 0.05	n/a	> 0.05	n/a	50	11.2	50	0.3	3.1
10336674	184	17.8	1.75E-22	BET-	-1.93	n/a	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
10336676	322	23.6	4.62E-14	BET+	0.54	n/a	> 0.05	n/a	> 0.05	n/a	38	11.1	38	0.2	2.3
10336740	188	23.8	> 0.05	BEV	no trend	0.04	> 0.05	n/a	> 0.05	n/a	26	3.7	26	0.0	0.0
10336770	209	20.8	3.59E-19	BET-	-0.38	n/a	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
10343500	230	53.1	5.07E-22	BET+	0.36	n/a	> 0.05	n/a	> 0.05	n/a	57	6.8	57	0.1	0.8
10353750	168	20.7	1.14E-10	BET+	0.20	n/a	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
10396000	113	16.2	> 0.05	BEV	no trend	0.04	> 0.05	n/a	> 0.05	n/a	61	5.3	61	1.5	9.0
11015000	194	23.5	1.23E-10	BET-	-0.87	n/a	3.74E-02	6.46E-04	> 0.05	n/a	54	14.5	46	0.0	0.1
11046300	106	14.5	2.15E-10	BET-	-0.92	n/a	> 0.05	n/a	> 0.05	n/a	58	39.0	57	0.0	0.2
11098000	250	21.7	3.46E-09	BET-	-0.34	n/a	> 0.05	n/a	> 0.05	n/a	61	5.9	61	0.0	0.2
11124500	163	20.2	3.40E-16	BET-	-3.37	n/a	1.84E-02	1.70E-03	> 0.05	n/a	60	18.1	60	0.0	0.5
11138500	198	30.4	> 0.05	BEV	no trend	0.14	> 0.05	n/a	2.12E-02	5.93E-02	60	13.4	60	0.1	1.7
11143000	447	50.9	1.55E-53	BET+	0.94	n/a	> 0.05	n/a	> 0.05	n/a	60	5.5	60	0.9	4.9
11148900	238	36.5	3.03E-02	BET-	-0.17	n/a	> 0.05	n/a	> 0.05	n/a	39	30.8	39	0.2	7.4
11151870	314	37.5	1.65E-20	BET+	1.84	n/a	> 0.05	n/a	> 0.05	n/a	23	9.1	23	1.1	9.4
11153470	115	36.5	> 0.05	BEV	no trend	0.06	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
11154700	137	14.8	7.04E-10	BET-	-0.89	n/a	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
11162500	533	58.3	5.83E-69	BET-	-0.75	n/a	> 0.05	n/a	> 0.05	n/a	59	8.9	59	0.2	1.9
11162570	351	38.9	5.08E-25	BET-	-1.12	n/a	> 0.05	n/a	> 0.05	n/a	41	10.0	41	0.2	1.4
11169800	145	37.5	2.90E-09	BET-	-0.36	n/a	> 0.05	n/a	> 0.05	n/a	50	40.4	50	0.0	1.6
11172945	121	13.7	> 0.05	BEV	no trend	0.08	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
11173200	263	40.7	3.02E-22	BET+	1.32	n/a	> 0.05	n/a	> 0.05	n/a	42	15.5	42	0.2	2.9
11180500	67	42.1	5.75E-03	BET-	-0.10	n/a	> 0.05	n/a	> 0.05	n/a	51	68.2	38	0.0	0.1
11180960	124	29.3	4.68E-22	BET-	-1.10	n/a	> 0.05	n/a	> 0.05	n/a	32	24.4	32	0.0	0.1
11203580	80	10.0	> 0.05	BEV	no trend	0.08	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
11230500	29	17.2	> 0.05	BEV	no trend	0.08	> 0.05	n/a	> 0.05	n/a	59	9.5	59	0.8	7.5
11253310	185	27.5	1.85E-36	BET-	-1.18	n/a	> 0.05	n/a	> 0.05	n/a	44	15.8	44	0.0	0.1
11264500	259	60.1	3.00E-19	BET-	-0.43	n/a	> 0.05	n/a	> 0.05	n/a	61	10.2	61	2.8	29.8
11274630	134	44.6	> 0.05	BEV	no trend	0.20	> 0.05	n/a	> 0.05	n/a	45	21.9	44	0.0	0.2
11284400	130	40.1	1.80E-02	BET+	0.14	n/a	> 0.05	n/a	> 0.05	n/a	41	28.2	41	0.0	0.3
11299600	114	22.3	> 0.05	BEV	no trend	0.04	> 0.05	n/a	> 0.05	n/a	27	43.3	27	0.0	0.2
11364300	42	20.3	4.75E-03	BET-	-0.06	n/a	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
11381500	213	55.2	2.19E-10	BET-	-1.02	n/a	> 0.05	n/a	> 0.05	n/a	61	2.4	61	6.2	14.8
11383500	219	45.9	2.40E-03	BET-	-1.22	n/a	> 0.05	n/a	> 0.05	n/a	61	3.5	61	4.5	18.1
11413323	23	15.5	> 0.05	BEV	no trend	0.06	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
11427700	43	24.1	4.35E-03	BET-	-0.60	n/a	> 0.05	n/a	> 0.05	n/a	48	9.3	48	0.3	3.1
11431800	216	22.9	5.48E-06	BET+	0.83	n/a	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
11449500	176	53.2	> 0.05	BEV	no trend	0.42	> 0.05	n/a	> 0.05	n/a	61	9.3	61	0.4	4.2

STAID	BE N msts	BE years	BE p	BE type	BET (cm/y)	BEV (m)	Q_{50}trend p	Q_{50}trend ($m^3/s/y$)	Q_{90}trend p	Q_{90}trend ($m^3/s/y$)	Q_{90}&Q_{50} years	Q_{90}/Q_{50}	Q_{90}/Q_{50} years	Q_{50} (m^3/s)	Q_{90} (m^3/s)
11468500	179	55.1	6.70E-04	BET-	-0.36	n/a	> 0.05	n/a	> 0.05	n/a	58	11.5	58	1.0	13.6
11473900	221	34.7	1.03E-30	BET-	-3.13	n/a	> 0.05	n/a	> 0.05	n/a	44	8.5	44	10.7	103.5
11475560	231	38.9	1.77E-06	BET-	-0.30	n/a	> 0.05	n/a	> 0.05	n/a	43	10.2	43	0.1	1.8
11478500	361	28.1	4.47E-54	BET-	-2.87	n/a	> 0.05	n/a	> 0.05	n/a	60	10.0	60	5.3	58.0
11481200	375	55.3	6.13E-06	BET+	0.08	n/a	> 0.05	n/a	> 0.05	n/a	55	8.5	55	1.0	9.3
11481500	355	33.7	1.28E-10	BET-	-1.15	n/a	> 0.05	n/a	> 0.05	n/a	57	7.3	57	2.1	15.0
12010000	168	43.4	4.34E-08	BET+	0.70	n/a	> 0.05	n/a	> 0.05	n/a	52	4.7	52	6.3	29.0
12020800	43	12.8	1.94E-02	BET+	3.40	n/a	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
12025000	162	37.7	> 0.05	BEV	no trend	1.00	> 0.05	n/a	> 0.05	n/a	61	4.6	61	7.7	34.0
12025700	132	38.5	> 0.05	BEV	no trend	0.21	> 0.05	n/a	> 0.05	n/a	43	3.9	43	3.2	12.9
12035000	173	60.7	4.90E-12	BET+	1.49	n/a	> 0.05	n/a	> 0.05	n/a	61	4.0	61	34.4	135.7
12040500	113	30.6	2.67E-17	BET+	1.63	n/a	> 0.05	n/a	> 0.05	n/a	36	3.8	36	71.9	279.4
12041200	123	24.3	3.92E-20	BET-	-2.24	n/a	> 0.05	n/a	> 0.05	n/a	50	2.5	50	50.1	131.2
12043000	131	28.5	> 0.05	BEV	no trend	0.15	3.15E-02	1.46E-01	> 0.05	n/a	35	4.3	35	14.8	66.7
12043300	103	27.5	4.77E-09	BET-	-0.72	n/a	> 0.05	n/a	> 0.05	n/a	48	4.4	48	5.2	24.7
12048000	159	58.3	4.30E-02	BET-	-0.12	n/a	> 0.05	n/a	> 0.05	n/a	61	2.4	61	8.6	20.2
12054000	131	52.6	2.54E-27	BET-	-1.52	n/a	1.65E-02	-3.72E-02	4.23E-02	-5.02E-02	59	2.4	59	9.1	20.8
12056500	133	23.3	2.64E-05	BET+	1.70	n/a	> 0.05	n/a	> 0.05	n/a	61	2.5	61	11.1	27.4
12060500	269	52.7	1.94E-18	BET-	-0.67	n/a	> 0.05	n/a	> 0.05	n/a	61	3.3	61	13.4	46.0
12073500	133	23.1	1.93E-02	BET-	-0.37	n/a	> 0.05	n/a	> 0.05	n/a	60	2.8	60	0.2	0.6
12079000	117	30.0	1.18E-12	BET-	-0.52	n/a	> 0.05	n/a	4.84E-02	-5.98E-02	61	3.9	61	4.1	17.2
12082500	161	52.4	> 0.05	BEV	no trend	0.59	> 0.05	n/a	> 0.05	n/a	61	2.0	61	18.3	36.3
12094000	118	19.9	> 0.05	BEV	no trend	0.12	4.72E-02	-1.72E-02	> 0.05	n/a	61	2.2	61	9.9	21.3
12095000	173	24.1	> 0.05	BEV	no trend	0.16	> 0.05	n/a	> 0.05	n/a	61	2.6	61	4.8	12.1
12096500	74	20.9	> 0.05	BEV	no trend	0.25	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
12097500	145	24.6	> 0.05	BEV	no trend	0.19	> 0.05	n/a	> 0.05	n/a	61	3.0	61	4.2	12.9
12097850	57	24.5	1.32E-03	BET-	-1.25	n/a	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
12108500	175	25.2	1.45E-11	BET+	0.97	n/a	1.99E-02	-4.24E-03	3.81E-02	-1.08E-02	57	2.8	57	1.1	3.1
12114500	112	20.3	2.09E-07	BET-	-1.25	n/a	> 0.05	n/a	> 0.05	n/a	61	3.1	61	3.0	9.4
12115700	130	21.3	> 0.05	BEV	no trend	0.25	> 0.05	n/a	> 0.05	n/a	25	3.9	25	0.4	1.5
12117000	136	49.1	1.21E-03	BET+	0.14	n/a	> 0.05	n/a	> 0.05	n/a	54	2.2	54	2.1	4.8
12137290	89	16.4	> 0.05	BEV	no trend	0.10	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
12141300	101	22.3	> 0.05	BEV	no trend	0.11	> 0.05	n/a	> 0.05	n/a	49	2.6	49	24.3	65.4
12142000	104	20.9	6.68E-06	BET-	-1.45	n/a	> 0.05	n/a	> 0.05	n/a	49	2.6	49	10.4	26.9
12147500	121	21.5	1.01E-20	BET-	-4.11	n/a	> 0.05	n/a	> 0.05	n/a	58	2.3	58	7.9	18.0
12167000	139	47.7	9.24E-07	BET-	-1.82	n/a	> 0.05	n/a	> 0.05	n/a	61	2.6	61	41.1	106.2
12175500	110	48.6	6.08E-10	BET+	2.02	n/a	> 0.05	n/a	> 0.05	n/a	61	3.3	61	11.5	38.9
12179900	60	12.4	3.19E-02	BET-	-0.93	n/a	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
12186000	133	24.0	9.08E-24	BET-	-2.11	n/a	3.63E-02	-6.78E-02	2.12E-02	-2.30E-01	61	2.6	61	23.6	62.3
12189500	121	22.1	3.30E-02	BET-	-0.34	n/a	> 0.05	n/a	> 0.05	n/a	61	2.3	61	98.0	225.7
12201500	76	12.0	5.38E-06	BET+	1.38	n/a	> 0.05	n/a	> 0.05	n/a	61	3.1	61	4.9	14.7
12209000	122	20.7	2.08E-12	BET-	-1.05	n/a	> 0.05	n/a	> 0.05	n/a	57	2.4	57	16.8	40.8
12210700	75	15.3	9.09E-04	BET+	4.27	n/a	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
12354000	66	23.3	1.82E-02	BET+	1.30	n/a	> 0.05	n/a	> 0.05	n/a	52	7.6	52	5.7	44.7
12358500	259	58.1	> 0.05	BEV	no trend	0.08	> 0.05	n/a	> 0.05	n/a	61	7.8	61	30.6	246.2
12359800	265	43.0	> 0.05	BEV	no trend	0.17	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
12375900	233	28.5	1.57E-22	BET+	0.42	n/a	> 0.05	n/a	> 0.05	n/a	27	5.7	27	0.3	1.5
12377150	218	25.8	8.55E-20	BET+	0.99	n/a	> 0.05	n/a	> 0.05	n/a	28	6.5	28	0.7	3.9
12381400	173	25.9	1.14E-02	BET-	-0.21	n/a	> 0.05	n/a	1.96E-02	1.11E-01	28	7.9	28	0.7	4.6
12387450	201	25.8	> 0.05	BEV	no trend	0.08	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
12388400	206	25.7	6.78E-11	BET+	0.18	n/a	> 0.05	n/a	> 0.05	n/a	26	6.7	26	0.2	1.2
12390700	219	33.9	2.06E-04	BET+	0.45	n/a	> 0.05	n/a	4.86E-02	-1.06E-01	54	6.4	54	2.9	18.3
12411000	221	44.1	> 0.05	BEV	no trend	0.12	> 0.05	n/a	> 0.05	n/a	60	6.8	60	7.8	54.0
12413875	87	13.9	1.04E-06	BET+	0.81	n/a	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
12414500	235	30.6	> 0.05	BEV	no trend	0.22	> 0.05	n/a	1.17E-02	-7.87E-01	61	6.0	61	29.7	190.5
12433542	241	25.9	9.70E-06	BET+	0.11	n/a	> 0.05	n/a	> 0.05	n/a	26	9.1	26	0.0	0.1
12447383	141	20.5	1.82E-02	BET-	-0.93	n/a	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
12447390	135	43.4	> 0.05	BEV	no trend	0.07	1.47E-02	2.88E-03	> 0.05	n/a	41	13.5	41	0.2	2.7
12451000	169	58.1	6.60E-03	BET+	0.34	n/a	> 0.05	n/a	4.11E-02	-3.67E-01	60	5.1	60	21.3	103.0
12452800	170	37.4	3.40E-06	BET-	-0.62	n/a	> 0.05	n/a	> 0.05	n/a	53	7.4	53	3.8	31.0
12452890	63	12.3	3.77E-02	BET+	0.37	n/a	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
12456500	120	18.9	> 0.05	BEV	no trend	0.04	> 0.05	n/a	> 0.05	n/a	55	6.4	55	6.2	41.6
12458000	111	34.3	3.48E-02	BET-	-1.19	n/a	> 0.05	n/a	9.53E-03	-2.31E-01	60	5.3	60	8.9	45.7
12488500	163	26.5	> 0.05	BEV	no trend	0.13	> 0.05	n/a	3.00E-02	-7.30E-02	60	4.7	60	3.5	15.9
13010065	231	24.0	3.98E-33	BET-	-2.03	n/a	> 0.05	n/a	> 0.05	n/a	27	6.4	27	10.4	65.9
13011900	304	38.0	> 0.05	BEV	no trend	0.32	> 0.05	n/a	> 0.05	n/a	45	8.2	45	5.7	46.4
13018300	207	20.7	3.86E-19	BET+	1.24	n/a	> 0.05	n/a	> 0.05	n/a	48	5.2	48	0.2	0.9
13023000	276	37.7	> 0.05	BEV	no trend	0.13	> 0.05	n/a	> 0.05	n/a	56	5.1	56	9.2	47.9
13046995	121	17.7	> 0.05	BEV	no trend	0.03	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
13083000	253	29.3	8.89E-04	BET-	-0.34	n/a	> 0.05	n/a	> 0.05	n/a	60	2.2	60	0.3	0.7
13161500	326	38.5	5.12E-03	BET-	-0.16	n/a	8.20E-03	-1.37E-02	> 0.05	n/a	44	9.6	44	0.9	9.2
13162225	135	13.1	4.55E-05	BET-	-1.10	n/a	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
13235000	258	48.4	> 0.05	BEV	no trend	0.11	> 0.05	n/a	> 0.05	n/a	61	5.3	61	11.5	65.4
13237920	86	10.3	> 0.05	BEV	no trend	0.13	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
13240000	181	25.7	> 0.05	BEV	no trend	0.41	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
13296500	106	31.1	> 0.05	BEV	no trend	0.21	3.67E-03	-5.67E-02	2.44E-02	-4.38E-01	61	5.0	61	14.1	77.1
13310199	46	14.9	1.76E-02	BET-	-4.68	n/a	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
13310700	227	33.6	4.45E-04	BET+	0.24	n/a	> 0.05	n/a	> 0.05	n/a	44	7.7	44	5.8	48.1
13313000	214	28.0	2.18E-03	BET-	-0.16	n/a	> 0.05	n/a	> 0.05	n/a	61	10.5	61	2.9	35.3
13331500	147	24.1	1.66E-03	BET-	-0.39	n/a	> 0.05	n/a	> 0.05	n/a	45	6.4	45	5.3	36.8
13337000	143	21.0	1.00E-02	BET-	-0.25	n/a	> 0.05	n/a	6.65E-03	-1.10E+00	61	7.5	61	32.8	233.6
13338500	156	20.8	> 0.05	BEV	no trend	0.12	2.82E-02	-1.06E-01	> 0.05	n/a	46	5.8	46	11.6	73.8
13339500	158	23.2	3.91E-14	BET-	-2.08	n/a	> 0.05	n/a	> 0.05	n/a	30	5.8	30	4.1	23.1
13340000	130	46.7	> 0.05	BEV	no trend	0.41	> 0.05	n/a	> 0.05	n/a	46	6.3	46	113.6	689.5
13340600	134	20.9	2.07E-02	BET-	-0.29	n/a	> 0.05	n/a	> 0.05	n/a	43	5.0	43	49.0	251.6
14020000	148	23.1	> 0.05	BEV	no trend	0.17	> 0.05	n/a	> 0.05	n/a	61	4.2	61	3.5	15.2
14020300	177	26.2	1.61E-02	BET+	0.48	n/a	> 0.05	n/a	> 0.05	n/a	35	7.3	35	2.1	15.7
14036860	69	15.2	2.93E-05	BET-	-1.13	n/a	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
14090350	124	22.4	2.41E-14	BET-	-0.46	n/a	> 0.05	n/a	> 0.05	n/a	24	1.5	24	2.4	3.7
14092750	127	23.4	> 0.05	BEV	no trend	0.05	> 0.05	n/a	> 0.05	n/a	28	2.2	28	1.6	3.6

STAID	BE N msts	BE years	BE p	BE type	BET (cm/y)	BEV (m)	Q_{50}trend p	Q_{50}trend ($m^3/s/y$)	Q_{90}trend p	Q_{90}trend ($m^3/s/y$)	Q_{90}&Q_{50} years	Q_{90}/Q_{50}	Q_{90}/Q_{50} years	Q_{50} (m^3/s)	Q_{90} (m^3/s)
14096300	115	22.5	8.01E-04	BET+	0.42	n/a	> 0.05	n/a	> 0.05	n/a	24	1.8	24	1.6	2.8
14096850	122	25.4	> 0.05	BEV	no trend	0.04	> 0.05	n/a	> 0.05	n/a	27	2.8	27	1.4	4.4
14107000	103	17.0	8.56E-04	BET+	0.56	n/a	> 0.05	n/a	> 0.05	n/a	61	4.0	61	5.5	22.0
14138800	118	23.0	> 0.05	BEV	no trend	0.17	> 0.05	n/a	> 0.05	n/a	47	4.2	47	0.9	3.7
14138870	142	35.1	> 0.05	BEV	no trend	0.09	> 0.05	n/a	> 0.05	n/a	35	3.3	35	0.6	2.2
14139800	142	24.8	2.90E-08	BET+	1.12	n/a	> 0.05	n/a	3.88E-02	3.25E-02	36	3.2	36	2.0	6.6
14150800	126	39.8	> 0.05	BEV	no trend	0.10	> 0.05	n/a	> 0.05	n/a	47	4.6	47	1.6	8.2
14154500	102	27.0	5.76E-11	BET+	1.06	n/a	> 0.05	n/a	> 0.05	n/a	61	4.8	61	8.2	39.7
14158500	121	24.3	> 0.05	BEV	no trend	0.11	> 0.05	n/a	> 0.05	n/a	61	1.8	61	11.1	21.5
14158790	122	24.0	5.57E-17	BET+	1.08	n/a	> 0.05	n/a	> 0.05	n/a	48	4.0	48	1.4	5.7
14159200	69	44.5	1.21E-02	BET-	-1.47	n/a	> 0.05	n/a	> 0.05	n/a	52	2.3	52	13.5	32.7
14161500	121	26.6	2.97E-07	BET+	1.14	n/a	> 0.05	n/a	> 0.05	n/a	61	3.7	61	2.0	7.4
14166500	143	26.6	> 0.05	BEV	no trend	0.16	> 0.05	n/a	4.86E-02	-6.76E-02	61	6.0	61	2.6	15.7
14179000	66	23.6	> 0.05	BEV	no trend	0.26	> 0.05	n/a	2.68E-02	-1.14E-01	60	2.5	60	11.9	32.1
14180300	56	10.4	> 0.05	BEV	no trend	0.09	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
14182500	130	44.7	> 0.05	BEV	no trend	0.49	> 0.05	n/a	3.41E-03	-2.04E-01	61	3.4	61	13.2	45.1
14185900	130	25.4	2.76E-03	BET-	-0.59	n/a	> 0.05	n/a	> 0.05	n/a	45	4.1	45	10.4	41.2
14187000	120	20.4	9.03E-08	BET+	0.83	n/a	1.70E-02	-2.01E-02	> 0.05	n/a	61	4.4	61	3.2	14.0
14198400	120	15.4	> 0.05	BEV	no trend	0.11	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
14216500	268	27.6	3.54E-17	BET-	-1.58	n/a	> 0.05	n/a	> 0.05	n/a	54	2.8	54	19.2	47.9
14231000	106	19.3	> 0.05	BEV	no trend	0.67	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
14236200	115	24.2	3.92E-02	BET+	0.41	n/a	> 0.05	n/a	> 0.05	n/a	54	3.3	54	15.0	49.6
14301000	188	61.8	8.75E-50	BET-	-1.69	n/a	> 0.05	n/a	> 0.05	n/a	61	6.0	61	31.9	199.5
14305500	138	25.8	1.42E-08	BET+	0.97	n/a	> 0.05	n/a	> 0.05	n/a	61	5.1	61	20.7	101.1
14306340	136	25.8	3.46E-12	BET+	0.65	n/a	> 0.05	n/a	> 0.05	n/a	27	6.3	27	0.3	1.6
14306500	126	37.8	> 0.05	BEV	no trend	0.20	> 0.05	n/a	9.72E-03	-5.73E-01	61	5.5	61	17.8	101.8
14307620	85	36.3	2.26E-02	BET+	0.42	n/a	> 0.05	n/a	3.09E-02	-1.22E+00	43	5.5	43	25.1	136.5
14308990	123	19.5	> 0.05	BEV	no trend	0.08	> 0.05	n/a	> 0.05	n/a	25	5.2	25	0.9	4.9
14309500	124	25.4	3.58E-02	BET+	0.29	n/a	> 0.05	n/a	1.93E-02	-1.02E-01	55	8.7	55	2.0	17.0
14316495	65	11.3	> 0.05	BEV	no trend	0.23	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
14316700	254	38.1	2.62E-10	BET-	-0.64	n/a	> 0.05	n/a	> 0.05	n/a	54	4.9	54	10.1	47.9
14318000	204	37.8	2.32E-10	BET+	0.39	n/a	> 0.05	n/a	> 0.05	n/a	56	4.9	56	6.0	30.2
14325000	219	37.7	1.34E-11	BET-	-0.85	n/a	> 0.05	n/a	5.54E-03	-2.91E-01	59	6.9	59	7.8	56.4
14362250	125	26.5	4.55E-05	BET-	-0.33	n/a	> 0.05	n/a	> 0.05	n/a	26	5.8	26	0.0	0.2
14400000	117	22.2	1.05E-02	BET-	-2.36	n/a	> 0.05	n/a	> 0.05	n/a	41	6.5	41	24.5	152.7
103366993	243	20.3	3.03E-28	BET+	0.44	n/a	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
103367592	199	21.4	1.03E-66	BET+	1.41	n/a	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
0204382800	69	16.1	> 0.05	BEV	no trend	0.31	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.	i.d.
0208111310	182	23.8	> 0.05	BEV	no trend	0.41	> 0.05	n/a	> 0.05	n/a	23	8.4	23	0.8	6.4

8.2. Chapter 3 Data

Sorted by USGS station ID (STAID)

Pages 199-204:

DA (km^2): USGS values of drainage area, measured at the stream gage
Elev. (m): USGS values of elevation, measured at the datum of the stream gage
Precip. (mm/year): mean annual precipitation averages, measured at the gage, from 800m PRISM data, 1971-2000 (http://www.prism.oregonstate.edu/)
Flow modification: relative level of relative flow modification (*Least*, *Intermediate*, or *Most*)
CC length (years): length of the trend in the flow frequency due to channel capacity (CC effect)
CC effect (%/decade): trend in the flow frequency due to channel capacity (IRLS unbiased-mean exponential curve), where the flow frequency due to channel capacity is the number of days in the year that the estimated volume of flow at flood stage ($\hat{Q}$) is equalled or exceeded, within the fixed historical flow frequency distribution.
CC effect SE (%/decade): standard error of the trend in the flow frequency due to channel capacity
CC effect p: significance of the trend in the flow frequency due to channel capacity
FF length (years): length of the trend in the flood stage flow frequency (FF effect)
Mean FF (days/year): mean of the annual flood stage flow frequencies (FF), where FF is the number of days in the year where the mean daily discharge equals or exceeds the average flow at flood stage, $\overline{Q_{FS}}$)
FF effect (%/decade): trend in the flood stage flow frequency (nonlinear least squares unbiased-mean exponential curve)
FF effect SE (%/decade): standard error of the trend in the flood stage flow frequency
FF effect p: significance of the trend in the flood stage flow frequency

Pages 204-208:

$\overline{U_{FS}}$ (m/s) $\overline{A_{FS}}$ (m^2) $\overline{w_{FS}}$ (m) $\overline{h_{FS}}$ (m) $\overline{Q_{FS}}$	Time-averaged values of average cross-sectional channel velocity (*U*), cross-sectional flow area (*A*), channel width (*w*), cross-sectional average channel depth (*h*), and cross-sectional discharge (*Q*), at flood stage (FS), obtained from the rating curves relating *U*, *A*, *w*, *h*, or *Q* to *G* (Gage height).

$\hat{Q}$ (%/decade): trend in the estimated values of cross-sectional channel discharge at flood stage ($\hat{Q}$)
$\hat{Q}$ SE (%/decade): standard error of the trend in $\hat{Q}$
$\hat{Q}$ p: significance of the trend in $\hat{Q}$
$\hat{A}$ (%/decade): trend in the estimated values of cross-sectional flow area at flood stage ($\hat{A}$)
$\hat{A}$ SE (%/decade): standard error of the trend in $\hat{A}$

$\hat{A}$ p: significance of the trend in $\hat{A}$

$\hat{U}$ (%/decade): trend in the estimated values of cross-sectional average flow velocity at flood stage ($\hat{U}$)

$\hat{U}$ SE (%/decade): standard error of the trend in $\hat{U}$

$\hat{U}$ p: significance of the trend in $\hat{U}$

Q_{50} (m^3/s): mean of the annual 50th streamflow percentiles, over the period of record, computed using USGS mean daily discharge data

Q_{90} (m^3/s): mean of the annual 90th streamflow percentiles, over the period of record, computed using USGS mean daily discharge data

STAID	DA (km^2)	Elev. (m)	Precip. (mm/y)	Flow modification	CC length (yrs)	CC effect (%/dec)	CC effect SE (%/dec)	CC effect p	FF length (yrs)	Mean FF (d/y)	FF effect (%/dec)	FF effect SE (%/dec)	FF effect p
01055000	251	188	1187	Least	33	-8.4	2.5	5.26E-03	62	0.44	6.7	10.8	5.39E-01
01064500	997	127	1199	Least	26	-2.4	2.8	4.11E-01	62	0.79	1.2	8.2	8.89E-01
01098530	275	34	1188	Most	23	-20.2	7.7	1.20E-02	32	7.97	49.0	20.1	3.39E-02
01099500	1036	21	1137	Intermediate	24	-3.2	4.9	5.25E-01	62	2.94	33.3	13.8	4.26E-02
01100000	12005	2	1133	Most	21	-16.3	9.7	1.08E-01	62	1.37	7.9	12.5	5.30E-01
01131500	3921	244	987	Intermediate	58	-1.0	1.7	5.67E-01	62	2.51	0.5	7.1	9.41E-01
01152500	697	109	999	Intermediate	61	-6.4	3.8	1.01E-01	62	0.06	5.7	26.9	8.18E-01
01196500	298	6	1305	Intermediate	24	42.9	8.8	1.06E-04	62	0.32	45.9	14.0	7.70E-03
01350355	1150	209	938	Most	27	12.7	6.8	8.39E-02	36	0.11	24.8	44.1	5.78E-01
01357500	8936	15	966	Intermediate	36	9.9	4.8	4.49E-02	62	0.13	48.9	25.7	9.89E-02
01364500	1085	12	1149	Most	24	-0.4	1.6	7.95E-01	41	1.50	57.2	19.6	1.64E-02
01389500	1974	37	1309	Intermediate	49	-6.2	1.3	3.47E-05	62	4.02	15.8	10.3	1.43E-01
01420500	624	351	1152	Least	55	1.1	1.2	3.87E-01	62	0.40	24.7	13.0	6.94E-02
01426500	1541	288	1118	Most	61	-1.3	1.7	4.51E-01	62	0.54	-23.4	12.2	7.24E-02
01447800	751	370	1201	Most	47	8.4	4.6	7.81E-02	54	0.18	38.1	32.8	2.86E-01
01465500	544	12	1248	Intermediate	31	1.2	2.8	6.84E-01	62	0.67	8.9	10.0	3.89E-01
01477000	158	7	1154	Intermediate	38	-5.2	1.8	1.10E-02	62	0.19	18.0	16.0	2.73E-01
01478000	53	7	1159	Intermediate	35	31.4	7.3	1.90E-04	62	0.13	18.8	21.1	3.85E-01
01479000	231	2	1147	Intermediate	36	-7.7	4.6	1.15E-01	62	0.33	15.3	17.7	4.01E-01
01480870	233	59	1211	Most	36	2.7	2.9	3.65E-01	39	0.88	10.9	22.2	6.38E-01
01503000	5781	256	990	Intermediate	42	-8.4	2.2	6.36E-04	62	3.35	5.9	8.1	4.76E-01
01509000	756	331	1019	Intermediate	35	4.6	1.3	2.01E-03	62	2.26	7.2	7.4	3.49E-01
01512500	3841	266	973	Intermediate	58	0.8	0.9	3.86E-01	62	0.84	0.3	10.9	9.76E-01
01531500	20194	212	895	Intermediate	21	7.2	3.7	6.98E-02	62	1.54	0.9	9.5	9.28E-01
01533400	22585	183	945	Intermediate	31	-1.3	1.8	4.85E-01	35	1.11	21.0	28.1	4.63E-01
01554000	47397	125	1089	Intermediate	38	0.1	3.1	9.81E-01	62	0.70	5.9	13.4	6.51E-01
01560000	445	320	991	Intermediate	43	-1.8	2.2	4.34E-01	62	1.22	25.1	9.6	2.11E-02
01568000	536	129	1084	Least	34	-0.5	3.5	8.93E-01	62	0.52	42.0	12.3	5.00E-03
01571500	552	94	1086	Intermediate	39	-2.0	1.8	2.96E-01	57	0.93	32.7	14.2	4.31E-02
01604500	572	190	934	Most	26	4.2	1.5	1.65E-02	62	0.67	-10.5	9.7	2.82E-01
01638500	24996	61	1077	Intermediate	29	3.3	3.4	3.48E-01	62	1.32	4.8	9.1	5.95E-01
02029000	11865	77	1137	Intermediate	56	-0.8	1.1	4.97E-01	62	0.43	11.4	14.1	4.29E-01
02035000	16193	50	1113	Intermediate	56	1.0	1.5	5.26E-01	62	0.87	6.2	11.5	5.90E-01
02039500	782	86	1150	Intermediate	39	-4.1	3.0	1.98E-01	62	1.38	7.0	10.4	5.02E-01
02049500	1588	0	1214	Intermediate	53	10.9	1.5	<1.00E-06	62	5.75	20.7	9.1	3.64E-02
02066000	7682	94	1167	Most	55	1.1	1.6	4.94E-01	61	5.11	5.6	7.4	4.55E-01
02071000	2727	156	1177	Intermediate	50	-7.7	2.9	2.10E-02	62	0.76	1.4	11.7	9.12E-01
02075500	6700	98	1160	Most	58	-3.5	1.5	2.66E-02	61	3.13	0.5	7.4	9.41E-01
02082585	2396	16	1191	Intermediate	36	-1.1	4.4	8.04E-01	35	1.14	-8.7	30.0	7.73E-01
02082950	458	35	1183	Least	53	7.1	1.3	3.75E-06	52	0.72	-1.3	15.8	9.32E-01
02083500	5654	3	1173	Intermediate	51	2.5	1.3	6.91E-02	62	8.68	1.8	8.0	8.22E-01
02088000	216	56	1192	Intermediate	44	-2.5	2.3	2.85E-01	62	0.21	-15.8	18.5	3.96E-01
02088500	601	33	1220	Intermediate	55	-1.9	2.4	4.47E-01	62	1.60	-5.9	13.0	6.48E-01
02089000	6213	13	1278	Most	51	1.1	1.1	3.01E-01	62	11.10	-4.6	9.1	6.20E-01
02089500	6972	3	1289	Most	40	0.4	1.3	7.78E-01	62	32.29	-5.3	6.2	4.00E-01
02096960	3302	86	1202	Intermediate	39	-4.6	1.0	1.55E-04	38	2.33	-28.7	14.8	7.38E-02
02104220	241	52	1214	Least	22	-16.7	2.8	<1.00E-06	23	2.29	-17.0	37.2	6.51E-01
02106500	1751	8	1289	Least	44	6.6	1.8	4.82E-04	60	2.44	14.9	13.0	2.70E-01
02131000	22870	8	1228	Intermediate	41	3.2	3.3	3.43E-01	62	22.46	-3.5	6.5	5.93E-01
02132000	2668	18	1090	Intermediate	47	-1.2	1.1	2.52E-01	62	3.35	1.1	11.0	9.27E-01
02175000	7071	6	1305	Intermediate	48	0.4	0.6	5.30E-01	62	31.19	-6.1	7.8	4.46E-01
02215500	13416	27	1190	Intermediate	63	0.7	1.4	6.09E-01	62	4.60	2.8	10.7	7.92E-01
02217500	1031	169	1250	Intermediate	41	-15.6	5.9	1.63E-02	62	0.13	-1.4	18.3	9.41E-01
02223500	11396	45	1208	Most	40	6.0	1.1	3.12E-06	62	5.22	-6.2	7.2	3.93E-01
02225500	2875	22	1210	Least	62	6.4	0.4	<1.00E-06	62	33.06	-1.2	5.4	8.17E-01
02226500	3108	20	1279	Least	46	-1.7	1.3	1.98E-01	62	6.97	3.2	8.0	6.86E-01
02228000	7226	5	1339	Intermediate	45	-1.6	0.6	9.94E-03	62	41.48	-1.1	5.6	8.49E-01
02231000	1813	13	1348	Least	58	0.7	1.0	4.73E-01	62	15.40	-5.3	6.8	4.45E-01
02295637	2139	9	1312	Most	25	-1.7	4.3	6.92E-01	62	5.03	-19.3	13.8	1.80E-01
02297310	565	3	1286	Least	48	18.1	1.9	<1.00E-06	61	7.06	-7.2	10.2	4.90E-01
02298830	593	2	1474	Intermediate	44	5.8	2.6	3.00E-02	62	30.98	-5.4	5.7	3.43E-01
02299950	169	12	1351	Least	41	10.7	3.2	1.85E-03	45	4.74	3.1	8.2	7.08E-01

STAID	DA (km^2)	Elev. (m)	Precip. (mm/y)	Flow modification	CC length (yrs)	CC effect (%/dec)	CC effect SE (%/dec)	CC effect p	FF length (yrs)	Mean FF (d/y)	FF effect (%/dec)	FF effect SE (%/dec)	FF effect p
02300500	386	0	1348	Most	30	10.6	4.4	2.83E-02	62	8.02	-7.6	6.5	2.54E-01
02312000	1476	15	1339	Intermediate	55	4.6	1.3	6.79E-04	62	11.60	-11.2	13.8	4.22E-01
02312500	2098	12	1317	Intermediate	54	7.3	5.5	1.99E-01	62	9.63	-12.4	14.8	4.10E-01
02313000	4727	8	1331	Most	41	0.4	0.9	6.45E-01	62	13.57	-34.6	18.3	9.38E-02
02315500	6294	0	1353	Least	25	12.4	2.0	1.94E-06	62	8.54	6.6	12.1	5.84E-01
02317500	3626	23	1327	Intermediate	59	-2.5	0.9	7.18E-03	62	5.57	4.7	10.1	6.47E-01
02323500	24968	0	1458	Intermediate	43	-7.1	1.9	5.36E-04	62	14.24	-1.2	11.5	9.16E-01
02326000	513	4	1475	Least	54	-4.7	1.0	4.49E-05	61	3.38	-1.1	14.8	9.42E-01
02327100	264	0	1602	Least	43	0.2	1.4	8.82E-01	47	1.79	5.8	14.6	6.88E-01
02329000	2953	18	1505	Intermediate	39	-1.9	1.1	9.74E-02	62	16.25	-0.1	7.2	9.89E-01
02336000	3756	229	1343	Most	38	10.7	10.9	3.33E-01	62	0.98	-64.4	13.3	1.00E-03
02339500	9195	168	1337	Most	24	-5.1	2.7	7.92E-02	62	0.76	-3.3	12.7	7.95E-01
02344350	337	231	1283	Intermediate	21	-16.5	1.5	<1.00E-06	26	1.93	-5.1	27.5	8.55E-01
02344700	262	222	1293	Least	28	-6.2	2.1	6.58E-03	47	1.50	-3.6	11.6	7.54E-01
02347500	4792	102	1241	Least	52	-2.8	1.2	2.88E-02	62	2.65	-5.1	8.3	5.36E-01
02352500	13753	46	1343	Most	30	4.6	3.0	1.49E-01	62	1.14	14.7	15.1	3.35E-01
02353000	14867	34	1350	Intermediate	26	-6.1	1.9	5.86E-03	55	2.23	3.6	15.4	8.18E-01
02359000	2023	6	1528	Least	44	-0.7	1.5	6.62E-01	62	2.28	12.0	12.3	3.44E-01
02366500	11355	0	1660	Least	24	1.2	1.6	4.63E-01	62	16.51	-0.1	6.5	9.81E-01
02368000	1616	14	1653	Intermediate	56	-0.2	1.1	8.71E-01	62	0.71	1.7	19.9	9.27E-01
02383500	2152	188	1363	Most	26	-7.6	5.3	1.71E-01	62	1.08	-39.3	12.7	1.24E-02
02384500	653	205	1438	Intermediate	29	-1.6	5.6	7.81E-01	30	2.68	-11.5	16.2	4.95E-01
02385800	166	210	1416	Intermediate	41	-4.6	6.1	4.55E-01	51	0.21	17.4	25.1	4.93E-01
02397000	10464	169	1384	Intermediate	33	4.0	3.5	2.68E-01	62	6.71	-10.1	7.6	2.18E-01
02398000	497	187	1429	Least	42	0.1	1.7	9.64E-01	62	1.37	-12.9	7.4	9.44E-02
02431000	1585	74	1462	Most	36	15.2	3.5	4.43E-04	62	0.43	-3.1	16.9	8.54E-01
02439400	2067	67	1474	Least	30	-1.2	0.9	1.72E-01	45	22.65	-6.5	6.7	3.39E-01
02456500	2292	79	1438	Intermediate	25	-4.8	2.6	9.12E-02	62	1.81	-3.8	8.1	6.29E-01
02473000	4527	36	1584	Intermediate	23	-1.3	4.3	7.76E-01	62	0.71	-11.0	19.7	5.70E-01
02474500	1585	32	1579	Least	40	-23.5	2.5	<1.00E-06	62	1.32	-4.5	14.6	7.64E-01
02478500	6967	16	1682	Intermediate	25	-5.4	1.9	7.46E-03	62	30.30	1.1	4.8	8.07E-01
02479560	1456	14	1674	Least	30	0.0	5.1	9.97E-01	38	0.85	3.4	29.8	9.06E-01
02481880	1347	115	1477	Intermediate	27	1.7	3.5	6.32E-01	31	23.09	-9.3	11.4	4.31E-01
02482000	2341	104	1436	Intermediate	30	-12.8	1.7	<1.00E-06	62	13.56	0.2	5.5	9.75E-01
02482550	3486	96	1466	Least	30	-4.1	2.3	8.53E-02	49	21.58	-5.7	7.6	4.51E-01
02483000	1064	98	1510	Least	30	-2.9	3.7	4.37E-01	62	16.69	2.6	4.7	5.91E-01
02484000	785	114	1450	Least	35	5.5	5.0	2.82E-01	62	2.08	1.7	10.3	8.60E-01
02488500	12932	48	1580	Intermediate	58	-9.5	1.5	<1.00E-06	62	18.75	1.6	6.9	8.20E-01
03015000	2113	372	1124	Intermediate	55	8.4	3.0	1.11E-02	62	0.89	-10.5	15.9	5.14E-01
03094000	1489	266	977	Most	54	-0.4	1.1	7.43E-01	62	2.33	-4.3	8.2	6.12E-01
03155000	3926	178	1118	Intermediate	59	4.5	4.6	3.34E-01	62	0.14	15.6	26.3	5.41E-01
03179000	1023	465	988	Intermediate	59	-1.6	0.6	1.82E-02	61	1.34	-0.4	9.0	9.60E-01
03200500	2233	174	1120	Intermediate	39	17.9	2.9	1.57E-05	50	0.31	-31.3	20.0	1.50E-01
03212500	5553	173	1136	Intermediate	45	2.2	7.9	7.83E-01	61	0.79	-51.9	13.7	5.30E-03
03213700	2424	189	1169	Least	33	-14.1	3.6	9.28E-04	44	0.38	8.7	19.8	6.62E-01
03237500	1002	156	1122	Least	60	3.0	2.9	3.25E-01	62	0.63	7.6	10.0	4.56E-01
03263000	2976	232	998	Most	22	10.4	6.3	1.28E-01	62	0.35	18.2	17.0	3.10E-01
03282000	6882	191	1226	Intermediate	40	-0.5	1.8	7.98E-01	62	1.29	-18.3	8.8	4.97E-02
03308500	4333	138	1313	Most	58	-6.7	1.7	7.85E-04	62	2.92	-35.2	8.3	2.00E-04
03322900	1173	246	962	Intermediate	23	0.6	2.0	7.67E-01	47	5.92	31.5	9.8	6.20E-03
03331500	2217	211	979	Least	23	23.7	4.9	6.23E-05	62	7.95	2.1	8.5	8.08E-01
03333450	378	250	1012	Least	25	6.0	4.5	2.13E-01	50	1.98	23.4	10.2	3.04E-02
03335500	18822	154	936	Intermediate	42	1.7	0.8	4.71E-02	62	35.14	10.6	3.9	8.10E-03
03336000	21285	144	1005	Intermediate	32	5.7	1.6	1.37E-03	62	38.65	9.7	3.9	1.91E-02
03339000	3341	154	1010	Intermediate	24	-23.9	3.2	1.68E-06	62	1.30	9.2	9.9	3.68E-01
03340500	28796	140	1081	Most	21	1.4	1.3	2.92E-01	62	56.46	7.4	3.6	4.98E-02
03341500	31761	136	1095	Intermediate	26	-1.1	1.0	2.45E-01	62	46.30	7.3	4.0	7.94E-02
03342000	34087	126	1076	Intermediate	62	3.5	0.4	<1.00E-06	62	52.06	9.6	4.0	2.10E-02
03343400	482	190	1028	Least	31	-0.2	3.2	9.50E-01	51	6.40	7.9	7.6	3.04E-01
03345500	3926	136	1086	Intermediate	44	-23.6	2.1	<1.00E-06	62	6.27	13.7	7.1	6.34E-02
03346000	824	139	1087	Least	26	1.2	4.3	7.88E-01	62	1.03	24.3	9.1	1.56E-02
03347000	624	280	988	Most	23	-6.4	5.3	2.52E-01	62	1.41	19.8	9.2	4.65E-02
03351310	46	217	1010	Least	22	-35.1	17.0	5.92E-02	42	0.07	1.7	45.4	9.66E-01
03352500	772	220	1029	Most	30	3.1	5.1	5.59E-01	62	1.32	24.8	10.0	2.16E-02
03353600	63	216	1010	Least	24	-12.9	9.6	2.01E-01	52	0.30	12.6	17.1	4.66E-01
03358000	635	215	1129	Intermediate	27	-6.2	3.5	9.61E-02	62	1.87	-0.8	8.5	9.27E-01
03360500	12142	142	1153	Intermediate	29	0.9	1.7	5.75E-01	62	25.40	8.7	4.2	4.37E-02
03361650	243	240	1052	Least	29	-20.4	7.4	1.37E-02	44	0.93	10.5	15.1	4.96E-01
03361850	204	231	1043	Intermediate	28	-2.8	4.9	5.77E-01	44	1.71	4.0	10.7	7.11E-01
03362500	1228	197	1074	Least	38	-6.6	5.7	2.77E-01	62	4.90	9.0	6.2	1.62E-01
03371500	10000	144	1173	Intermediate	28	4.8	1.4	1.82E-03	54	14.31	15.8	6.3	1.94E-02
03374000	28814	122	1150	Intermediate	28	0.7	1.4	5.90E-01	62	38.16	6.2	4.0	1.29E-01
03376500	2129	119	1164	Most	23	-11.0	2.9	3.77E-04	62	16.98	-9.3	6.9	1.80E-01
03377500	74165	113	1167	Most	27	0.2	1.2	8.60E-01	62	32.60	6.6	4.8	1.70E-01
03379500	2929	120	1104	Most	31	3.3	1.6	4.91E-02	62	40.54	10.5	3.8	7.50E-03
03403500	2486	287	1294	Intermediate	55	-1.8	3.1	5.62E-01	54	3.98	-5.5	6.6	3.92E-01
03436100	2398	115	1316	Least	35	0.1	1.3	9.38E-01	50	1.42	-1.1	11.7	9.26E-01
03443000	767	628	1494	Intermediate	43	3.2	1.5	3.93E-02	62	5.67	-0.5	6.2	9.40E-01
03451500	2448	594	968	Intermediate	59	0.6	0.7	4.19E-01	62	0.22	19.0	23.8	4.44E-01
03453500	3450	502	1010	Intermediate	56	-8.0	2.3	2.44E-03	62	0.38	4.1	16.2	8.01E-01
03455000	4812	308	1163	Intermediate	26	-4.5	3.0	1.63E-01	62	0.85	-4.3	10.8	6.89E-01
03524000	1380	457	1068	Intermediate	46	-1.7	5.7	7.71E-01	62	0.63	-22.4	10.7	5.41E-02
03575000	886	195	1451	Least	32	-6.2	2.0	6.46E-03	44	0.37	17.7	22.4	4.47E-01
04024000	8884	336	793	Intermediate	43	5.1	1.4	1.17E-03	62	1.95	-4.0	13.4	7.63E-01

STAID	DA (km^2)	Elev. (m)	Precip. (mm/y)	Flow modification	CC length (yrs)	CC effect (%/dec)	CC effect SE (%/dec)	CC effect p	FF length (yrs)	Mean FF (d/y)	FF effect (%/dec)	FF effect SE (%/dec)	FF effect p
04041500	896	216	836	Most	22	4.1	6.0	5.01E-01	62	2.27	-20.3	8.3	2.31E-02
04062500	1699	396	763	Most	20	-4.8	1.5	5.30E-03	62	1.00	-58.1	15.1	2.70E-03
04073500	3471	227	814	Intermediate	52	11.4	0.9	<1.00E-06	62	8.22	-1.6	14.3	9.11E-01
04079000	5853	228	808	Intermediate	53	7.8	1.9	1.34E-04	62	4.40	-10.0	10.2	3.30E-01
04085427	1362	180	776	Intermediate	35	-0.2	4.3	9.67E-01	39	0.63	-51.9	54.5	3.60E-01
04087204	65	192	873	Intermediate	36	-39.3	9.4	4.02E-04	48	0.10	144.0	59.6	9.08E-02
04087240	492	187	896	Least	39	7.4	3.7	5.77E-02	48	0.20	44.6	37.3	2.72E-01
04099750	935	248	945	Intermediate	22	7.4	9.0	4.25E-01	43	9.30	14.3	14.9	3.52E-01
04101500	9495	193	1006	Most	58	1.7	1.3	2.12E-01	62	2.78	10.4	15.0	4.86E-01
04106000	2616	230	948	Intermediate	20	4.1	6.1	5.14E-01	62	0.43	-0.9	23.9	9.65E-01
04113000	3186	245	825	Intermediate	59	2.1	1.3	1.32E-01	62	0.71	-16.7	16.4	3.25E-01
04115000	1124	196	846	Least	28	23.5	3.0	<1.00E-06	62	5.56	1.7	8.9	8.44E-01
04116000	7356	188	901	Intermediate	63	3.8	2.0	6.89E-02	60	0.56	-13.4	18.8	4.73E-01
04119000	12691	179	931	Intermediate	44	6.1	4.0	1.51E-01	62	0.17	4.5	25.3	8.58E-01
04121500	3711	298	842	Intermediate	36	6.5	3.5	7.14E-02	62	0.78	-16.4	17.8	3.68E-01
04122500	1764	182	865	Least	23	-23.2	10.6	3.86E-02	62	0.33	5.3	17.9	7.58E-01
04142000	829	198	776	Intermediate	27	-6.1	3.8	1.35E-01	62	4.76	-2.6	6.1	6.69E-01
04144500	1393	216	836	Intermediate	33	-1.5	4.5	7.35E-01	62	1.98	-9.3	12.0	4.52E-01
04151500	2178	178	810	Intermediate	24	-1.4	1.5	3.50E-01	62	3.17	7.6	8.4	3.82E-01
04154000	1077	217	812	Most	36	2.1	3.1	5.02E-01	62	1.70	-12.5	13.2	3.54E-01
04164000	1150	176	833	Least	20	-6.6	7.8	4.18E-01	62	0.33	5.3	15.9	7.37E-01
04168000	215	181	841	Most	52	1.2	2.2	5.96E-01	62	0.62	0.9	12.6	9.47E-01
04178000	1580	242	921	Intermediate	27	11.9	3.0	2.50E-04	62	14.00	-2.0	5.7	7.29E-01
04181500	1608	232	908	Intermediate	62	-1.9	1.9	3.30E-01	62	9.14	15.4	6.6	3.12E-02
04182000	1974	228	943	Intermediate	34	1.5	3.9	7.13E-01	62	2.19	18.1	9.0	5.76E-02
04183000	5095	221	953	Intermediate	24	3.5	1.8	7.72E-02	55	5.32	25.3	8.3	5.60E-03
04186500	860	218	916	Intermediate	35	-4.2	2.1	6.04E-02	62	3.19	9.1	7.1	2.14E-01
04193500	16395	182	869	Intermediate	22	-15.0	4.1	1.05E-03	62	7.54	3.8	6.3	5.63E-01
04201500	692	198	979	Intermediate	22	0.3	7.2	9.70E-01	62	1.79	21.4	6.8	4.10E-03
04229500	508	186	858	Intermediate	23	6.3	15.7	6.94E-01	61	0.22	1.3	22.6	9.55E-01
04230500	518	171	868	Intermediate	27	-9.1	7.0	2.07E-01	62	1.48	-6.0	8.7	4.95E-01
04282000	795	145	1001	Intermediate	40	1.5	2.2	5.16E-01	62	3.08	-3.9	6.5	5.61E-01
04293500	1241	123	1000	Least	26	-12.6	8.0	1.41E-01	62	0.40	36.6	16.8	6.24E-02
05059700	2183	322	520	Intermediate	22	-16.9	3.2	5.63E-06	55	2.79	81.1	20.0	5.80E-03
05062000	2525	268	583	Least	46	-10.0	0.8	<1.00E-06	62	17.25	26.0	6.1	3.00E-04
05064500	56462	252	549	Intermediate	28	-4.8	2.3	4.47E-02	50	8.14	46.5	14.3	7.90E-03
05066500	3116	268	529	Least	24	-8.2	4.3	7.04E-02	62	2.16	44.9	13.5	5.10E-03
05079000	13649	254	535	Most	61	-0.1	0.8	9.05E-01	62	6.27	9.2	9.3	3.32E-01
05082500	77959	237	529	Intermediate	26	-10.8	2.1	2.58E-06	62	17.16	30.3	7.2	5.00E-04
05227500	15903	360	740	Most	30	2.0	1.1	7.12E-02	62	61.02	-2.2	4.7	6.35E-01
05280000	6838	272	746	Least	50	-5.5	1.3	1.51E-04	62	6.43	20.2	12.2	1.18E-01
05330000	41958	210	755	Intermediate	22	-8.1	4.1	5.65E-02	62	6.62	35.4	14.7	3.83E-02
05374000	2979	247	821	Intermediate	51	-8.4	2.3	1.88E-03	29	0.70	-14.7	43.5	7.36E-01
05382000	5387	201	858	Intermediate	41	6.2	1.6	5.98E-04	62	2.65	-7.1	7.9	3.80E-01
05404000	20953	244	852	Most	48	-45.7	2.3	<1.00E-06	62	1.14	-10.6	17.0	5.53E-01
05412500	4002	193	860	Least	61	8.5	1.3	<1.00E-06	62	2.46	-1.6	9.5	8.70E-01
05413500	697	185	864	Least	61	-13.9	2.2	<1.00E-06	62	0.97	-40.5	11.7	5.50E-03
05430500	8651	226	879	Most	24	5.7	1.3	1.26E-04	62	11.98	30.3	12.0	2.36E-02
05437500	16480	216	900	Intermediate	28	-1.4	2.3	5.37E-01	62	7.56	25.9	14.8	1.17E-01
05439000	201	254	944	Least	25	0.0	9.4	9.99E-01	32	0.42	-4.8	38.9	8.97E-01
05446500	24732	172	934	Intermediate	32	2.0	0.9	4.15E-02	62	18.27	21.5	9.8	4.08E-02
05449500	1111	348	843	Least	60	3.6	1.6	3.06E-02	62	0.69	3.8	17.0	8.20E-01
05451500	3968	260	893	Intermediate	59	20.0	3.2	<1.00E-06	62	0.57	21.6	23.1	3.68E-01
05451900	145	240	906	Least	33	7.4	5.8	2.16E-01	62	0.13	3.2	23.0	8.90E-01
05453100	7236	220	907	Least	48	-2.6	0.5	1.47E-06	55	30.11	13.6	9.2	1.55E-01
05455500	1487	193	909	Least	58	6.1	0.7	<1.00E-06	62	4.78	22.0	10.5	5.71E-02
05458000	793	297	892	Least	59	3.4	1.6	4.34E-02	57	1.45	6.7	12.4	5.95E-01
05462000	4522	270	879	Intermediate	54	27.0	3.0	<1.00E-06	58	0.49	6.2	19.5	7.54E-01
05463000	899	269	880	Least	60	17.2	2.3	<1.00E-06	62	0.14	29.7	23.9	2.61E-01
05464000	13328	251	861	Intermediate	58	-6.6	0.8	<1.00E-06	62	2.81	10.7	13.6	4.46E-01
05465000	20168	177	922	Least	44	1.9	1.6	2.50E-01	62	14.16	24.2	11.6	6.98E-02
05465500	32375	164	902	Most	33	-1.3	1.5	3.83E-01	62	19.78	21.8	10.0	5.25E-02
05471050	2080	235	887	Intermediate	38	-11.1	3.4	1.69E-03	26	2.28	60.1	49.8	2.75E-01
05472500	1891	199	903	Intermediate	63	-4.2	0.8	3.02E-06	62	7.63	30.5	11.0	2.15E-02
05474000	11168	159	956	Intermediate	61	-9.0	1.1	<1.00E-06	62	6.32	32.1	11.5	2.01E-02
05476750	5843	321	825	Intermediate	32	-1.0	1.9	6.07E-01	47	5.56	24.6	28.7	4.11E-01
05479000	3388	317	825	Intermediate	49	-11.0	2.1	2.84E-06	62	0.29	24.1	26.4	3.75E-01
05481000	2186	302	854	Least	57	-2.9	0.9	2.85E-03	62	0.41	124.8	41.6	6.43E-02
05481300	14121	272	858	Intermediate	40	-9.6	3.6	1.52E-02	44	1.62	43.2	36.2	2.75E-01
05481950	927	246	870	Least	49	-27.1	4.5	<1.00E-06	51	0.23	50.4	27.6	1.06E-01
05482300	1813	349	827	Least	23	-3.0	2.8	2.81E-01	53	10.04	9.8	10.9	3.75E-01
05483450	971	317	866	Intermediate	34	42.8	3.3	<1.00E-06	32	17.79	-1.8	17.6	9.19E-01
05484500	8912	256	877	Intermediate	57	-7.2	2.1	1.19E-03	62	1.41	27.4	14.0	8.30E-02
05485640	240	243	873	Least	38	-13.0	3.5	1.17E-03	40	0.34	28.6	31.2	3.65E-01
05486000	904	240	883	Least	44	-3.6	4.6	4.37E-01	62	0.60	34.4	14.8	4.47E-02
05488500	32321	204	911	Most	52	-40.4	1.2	<1.00E-06	62	12.76	30.7	14.9	8.09E-02
05489500	34639	190	922	Most	29	-16.3	4.0	8.58E-05	62	9.90	43.9	18.6	5.18E-02
05490500	36358	167	942	Most	21	-27.7	4.7	3.31E-06	62	3.24	73.5	29.0	6.53E-02
05495000	1036	153	962	Least	23	10.1	3.1	8.15E-03	62	1.90	34.8	10.1	4.00E-03
05502300	945	214	986	Most	58	-21.7	1.7	<1.00E-06	37	6.05	8.0	13.3	5.53E-01
05515500	1391	203	997	Least	23	2.1	5.4	6.96E-01	62	38.08	2.4	5.5	6.67E-01
05517000	1127	207	998	Least	23	0.0	8.7	9.99E-01	62	1.83	9.2	11.1	4.13E-01
05517530	3564	197	984	Least	29	0.4	2.6	8.66E-01	37	14.53	-10.7	16.5	5.30E-01
05522500	526	196	976	Intermediate	26	13.1	4.0	4.82E-03	62	3.60	22.9	9.5	2.91E-02

STAID	DA (km²)	Elev. (m)	Precip. (mm/y)	Flow modification	CC length (yrs)	CC effect (%/dec)	CC effect SE (%/dec)	CC effect p	FF length (yrs)	Mean FF (d/y)	FF effect (%/dec)	FF effect SE (%/dec)	FF effect p
05524500	1163	190	964	Least	28	1.2	6.5	8.55E-01	61	6.23	20.7	6.8	4.50E-03
05525000	1777	187	971	Least	32	-3.8	4.2	3.72E-01	62	9.52	8.4	6.4	1.99E-01
05525500	1155	190	965	Least	31	6.3	3.9	1.15E-01	62	2.97	20.2	6.9	6.80E-03
05526000	5416	182	946	Least	30	-0.7	4.7	8.87E-01	62	1.03	16.5	12.9	2.22E-01
05527800	319	202	892	Most	21	4.8	6.3	4.54E-01	44	28.33	3.2	8.4	7.03E-01
05529000	932	191	937	Least	22	12.6	3.8	6.32E-03	62	5.29	17.0	8.7	6.21E-02
05536275	269	179	972	Intermediate	30	-37.1	4.6	<1.00E-06	62	1.94	17.1	5.9	7.80E-03
05536290	539	175	971	Intermediate	31	11.6	3.2	1.78E-03	62	0.60	-1.2	11.6	9.21E-01
05540500	839	172	941	Least	24	-0.4	3.2	9.03E-01	62	0.79	24.8	11.2	4.31E-02
05543830	326	242	882	Intermediate	40	14.0	5.6	2.61E-02	49	0.96	66.0	21.9	1.88E-02
05548280	497	227	900	Least	26	6.1	2.7	3.10E-02	45	15.91	-1.5	10.1	8.89E-01
05555300	3240	159	942	Intermediate	22	9.2	4.6	6.29E-02	62	3.32	9.8	7.8	2.22E-01
05569500	2776	155	939	Intermediate	25	3.5	4.3	4.27E-01	62	7.40	9.7	7.1	1.86E-01
05572000	1425	191	1008	Least	32	13.1	1.8	<1.00E-06	62	11.44	10.7	5.8	8.25E-02
05578500	868	186	995	Most	32	12.2	2.3	2.93E-06	62	33.22	10.0	5.1	5.77E-02
05584500	1696	150	958	Intermediate	27	-4.5	3.1	1.68E-01	62	6.02	18.1	7.7	3.01E-02
05592500	5025	138	1003	Most	63	2.1	1.1	6.57E-02	62	14.41	-0.9	5.7	8.78E-01
06025500	6413	1534	250	Intermediate	32	6.7	2.0	2.10E-03	62	3.57	-5.8	12.6	6.50E-01
06043500	2137	1575	529	Intermediate	32	-6.3	3.7	1.05E-01	62	0.27	10.0	30.4	7.31E-01
06054500	37993	1190	300	Intermediate	29	-0.2	2.7	9.47E-01	62	1.08	31.0	22.6	2.15E-01
06099500	8397	941	286	Most	26	33.0	4.7	<1.00E-06	62	0.78	-13.3	16.0	4.08E-01
06115200	106156	683	428	Most	33	24.8	4.8	1.55E-05	62	1.81	-14.1	20.9	4.98E-01
06334500	5113	948	367	Most	28	9.2	3.8	2.52E-02	55	1.95	23.5	16.1	1.67E-01
06340500	5802	522	424	Intermediate	25	-8.6	3.5	3.00E-02	62	0.89	-28.4	15.8	9.85E-02
06349500	4351	499	498	Intermediate	25	-15.5	9.5	1.28E-01	62	1.90	22.1	20.3	3.17E-01
06354000	10619	510	418	Intermediate	25	2.8	2.2	2.10E-01	62	2.71	-0.3	12.0	9.74E-01
06354882	917	515	438	Intermediate	26	-8.9	1.5	5.31E-05	27	2.77	31.7	34.8	3.89E-01
06360500	12675	506	452	Intermediate	26	-2.2	3.0	4.62E-01	57	0.52	85.9	28.3	2.89E-02
06436760	1194	826	437	Most	29	-6.1	8.7	5.04E-01	30	0.26	140.1	53.9	3.50E-02
06437000	15076	770	425	Intermediate	51	-3.9	4.4	3.92E-01	62	0.16	173.8	43.3	3.45E-02
06441500	8151	435	483	Least	28	-17.1	7.1	2.56E-02	62	0.59	-39.7	19.2	7.96E-02
06471000	14729	388	518	Most	29	-6.8	2.7	1.39E-02	62	33.73	51.4	11.2	7.00E-04
06471500	3895	399	524	Most	42	-7.3	3.9	7.49E-02	62	1.46	68.1	17.2	3.20E-03
06473000	25136	379	523	Most	29	-12.7	1.4	<1.00E-06	62	22.60	107.7	20.4	2.60E-03
06477000	45584	368	569	Most	26	-4.3	1.1	3.14E-04	61	23.65	77.0	15.6	8.00E-04
06477500	1520	395	580	Least	33	4.3	2.5	9.36E-02	56	4.47	25.7	14.8	1.07E-01
06479010	5835	343	655	Intermediate	27	-44.5	3.1	<1.00E-06	28	2.69	-60.7	58.2	3.19E-01
06479525	2836	508	599	Intermediate	27	3.3	2.5	1.88E-01	35	10.36	33.8	26.8	2.34E-01
06480000	8645	473	635	Intermediate	29	-16.3	1.2	<1.00E-06	58	12.14	44.9	14.3	1.13E-02
06481000	10168	444	652	Intermediate	29	4.9	1.8	7.62E-03	62	6.11	29.3	14.6	6.71E-02
06607500	9132	311	772	Intermediate	54	-13.9	3.2	9.13E-05	62	0.18	-1.6	24.3	9.45E-01
06625000	686	2124	282	Intermediate	31	5.3	4.3	2.28E-01	62	0.29	300.5	76.3	3.42E-02
06795500	761	437	729	Least	44	-4.6	4.7	3.44E-01	62	0.33	29.6	19.2	1.39E-01
06796000	182336	385	811	Most	31	-35.3	8.6	1.76E-04	62	0.32	-0.4	18.7	9.84E-01
06799350	12111	394	749	Intermediate	33	33.3	7.4	5.26E-05	39	0.65	67.4	47.1	2.28E-01
06800000	953	369	769	Most	21	-28.9	10.2	1.24E-02	60	0.39	12.4	16.4	4.50E-01
06805500	221108	307	834	Most	38	-20.2	3.4	<1.00E-06	58	0.69	28.9	24.7	2.73E-01
06807000	1061900	276	855	Most	46	13.3	0.4	<1.00E-06	62	12.70	42.9	16.1	3.23E-02
06807410	1577	331	903	Intermediate	28	0.9	4.4	8.34E-01	52	0.32	-3.7	18.8	8.42E-01
06811500	2051	271	838	Most	40	3.4	2.6	2.04E-01	62	0.29	-2.1	14.7	8.86E-01
06818000	1104635	241	904	Most	25	-1.6	2.3	4.82E-01	62	21.48	19.3	10.5	8.25E-02
06847000	5387	660	595	Most	23	20.1	2.5	<1.00E-06	43	0.41	-128.9	54.0	1.04E-01
06853020	57239	493	692	Most	23	14.2	5.0	9.27E-03	22	0.78	-29.2	83.3	7.14E-01
06876700	995	380	768	Intermediate	20	-15.3	4.8	5.10E-03	52	2.43	0.8	20.7	9.68E-01
06876900	17534	354	788	Most	62	-0.3	2.4	9.17E-01	62	3.49	-84.9	21.9	1.16E-02
06880000	1134	436	736	Intermediate	42	-6.0	1.6	3.43E-04	39	2.34	32.4	15.2	4.58E-02
06881000	7019	400	756	Intermediate	22	3.3	1.4	3.14E-02	58	5.53	0.1	8.4	9.91E-01
06882000	11518	354	817	Most	31	-19.3	4.2	9.00E-05	62	1.52	-16.4	12.7	2.13E-01
06890100	1116	281	940	Intermediate	44	-25.2	6.0	7.17E-04	42	0.12	-28.1	34.8	4.28E-01
06894000	477	219	1050	Most	27	9.5	7.6	2.23E-01	62	0.25	10.1	14.7	4.94E-01
06897500	5828	216	967	Intermediate	20	-11.2	6.2	8.92E-02	62	2.49	17.9	11.0	1.28E-01
06898000	1816	266	931	Most	45	-21.8	4.1	8.38E-06	62	0.46	21.9	16.9	2.19E-01
06902000	17819	192	975	Intermediate	34	-2.2	1.1	5.55E-02	62	20.38	8.2	6.0	1.84E-01
06905500	4843	193	963	Intermediate	57	-22.8	1.8	<1.00E-06	62	5.87	12.1	8.5	1.69E-01
06906800	1406	199	1016	Least	24	1.5	2.3	5.13E-01	24	3.76	-23.8	26.0	3.83E-01
06913500	3238	261	991	Intermediate	20	-8.0	3.7	4.95E-02	62	1.17	-6.6	12.9	6.11E-01
06934500	1353275	147	1163	Most	24	-6.6	1.0	<1.00E-06	62	26.24	14.5	8.1	8.76E-02
07010000	1805230	116	1040	Most	50	-1.8	1.0	7.08E-02	62	14.02	22.4	11.3	7.07E-02
07014500	3820	177	1057	Least	63	-4.1	1.2	1.77E-03	62	6.75	2.1	5.9	7.31E-01
07016500	2093	149	1079	Least	63	1.0	1.0	3.23E-01	62	2.79	11.6	9.2	2.36E-01
07018100	1904	159	1059	Intermediate	25	1.9	2.1	4.00E-01	62	3.02	1.7	7.2	8.16E-01
07019000	9811	123	1050	Intermediate	33	-9.0	2.6	2.31E-03	62	4.06	9.2	8.3	2.71E-01
07022000	1847188	91	1189	Most	54	-11.2	2.2	<1.00E-06	62	28.95	22.0	8.7	2.06E-02
07029500	3833	99	1408	Least	27	7.2	3.4	4.12E-02	62	1.48	8.1	10.6	4.60E-01
07060500	25848	96	1173	Most	25	0.7	1.6	6.57E-01	62	0.78	-74.0	21.8	1.58E-02
07072500	19088	70	1271	Intermediate	24	-1.4	1.4	3.23E-01	62	54.62	1.2	5.0	8.12E-01
07147800	4869	330	913	Most	28	-14.5	4.3	4.04E-03	62	2.56	-0.6	9.5	9.52E-01
07151000	11577	284	907	Most	27	-5.6	2.6	4.06E-02	62	3.14	11.5	10.0	2.56E-01
07153000	1393	245	1002	Most	26	-27.1	2.8	<1.00E-06	62	0.56	11.0	16.5	5.04E-01
07171000	9283	197	1059	Most	26	-2.9	3.6	4.30E-01	62	1.40	12.4	12.4	3.31E-01
07185000	15348	228	1145	Most	29	-3.8	1.7	3.98E-02	62	12.73	6.8	6.6	3.05E-01
07186000	3015	254	1148	Least	24	0.9	3.3	7.80E-01	62	1.95	19.6	9.1	4.57E-02
07188000	6516	227	1157	Intermediate	23	-10.1	2.7	1.80E-03	62	2.06	13.8	9.3	1.61E-01
07195500	1632	272	1213	Intermediate	36	-1.5	1.2	2.15E-01	56	2.12	2.0	7.9	7.94E-01

STAID	DA (km^2)	Elev. (m)	Precip. (mm/y)	Flow modification	CC length (yrs)	CC effect (%/dec)	CC effect SE (%/dec)	CC effect p	FF length (yrs)	Mean FF (d/y)	FF effect (%/dec)	FF effect SE (%/dec)	FF effect p
07227500	50363	911	488	Most	58	-41.9	22.4	6.46E-02	62	0.16	-64.7	26.0	6.32E-02
07230500	1199	274	966	Most	28	-110.5	23.9	4.30E-05	62	16.70	11.0	8.1	1.97E-01
07241550	35677	322	961	Most	25	-14.3	8.1	1.02E-01	43	1.32	22.5	22.6	3.43E-01
07268000	1362	83	1468	Least	27	24.8	10.0	3.02E-02	61	2.42	1.0	6.9	8.83E-01
07312200	1689	302	715	Most	26	-0.8	1.8	6.73E-01	51	2.50	4.2	14.2	7.66E-01
07312500	8133	282	756	Most	22	-2.3	3.7	5.33E-01	62	1.21	-27.8	14.3	7.36E-02
07336200	2924	128	1188	Intermediate	29	2.3	5.0	6.56E-01	39	1.65	-12.8	16.0	4.24E-01
07340000	6889	91	1389	Most	43	-4.2	2.0	4.67E-02	62	3.33	-81.7	11.4	<1.00E-06
07340500	935	116	1402	Most	29	-4.9	1.7	6.02E-03	29	1.37	-34.5	24.9	1.96E-01
07346045	945	52	1272	Least	24	-4.1	2.0	5.57E-02	43	21.89	-4.7	10.0	6.52E-01
07348700	1567	53	1349	Least	43	-0.7	0.8	3.77E-01	54	70.84	-0.9	4.9	8.52E-01
07375000	267	19	1690	Least	37	0.4	3.6	9.11E-01	62	2.07	1.3	7.8	8.70E-01
07375500	1673	2	1671	Intermediate	58	10.0	2.1	1.02E-04	62	9.68	4.2	5.4	4.43E-01
08015500	4403	4	1631	Intermediate	26	-1.9	2.8	5.03E-01	62	11.55	1.5	6.3	8.10E-01
08019000	1515	97	1119	Most	49	-0.7	2.2	7.58E-01	62	9.57	5.0	6.2	4.26E-01
08028000	945	36	1513	Intermediate	47	-12.1	1.4	<1.00E-06	60	8.34	9.1	6.9	1.99E-01
08032000	2966	80	1161	Intermediate	41	-7.1	0.8	<1.00E-06	62	59.56	4.5	5.1	3.82E-01
08038000	1303	52	1354	Most	49	-4.0	1.1	7.00E-04	34	31.39	29.8	15.3	7.01E-02
08039100	231	58	1339	Intermediate	46	-5.6	2.9	6.95E-02	24	2.44	36.1	27.0	1.98E-01
08041000	20593	3	1458	Most	42	-5.0	5.0	3.19E-01	62	1.35	-95.7	30.3	3.46E-02
08041500	2227	8	1489	Least	42	-3.3	1.8	7.44E-02	62	3.86	6.7	8.2	4.08E-01
08041700	870	0	1467	Intermediate	41	3.2	1.5	4.06E-02	44	29.16	0.5	7.6	9.47E-01
08057000	15815	112	965	Most	26	-14.6	4.7	3.45E-03	62	18.14	12.3	7.7	1.23E-01
08065000	33237	53	1101	Intermediate	60	-16.8	0.9	<1.00E-06	62	25.41	14.5	6.5	3.55E-02
08065350	36029	43	1144	Most	21	-14.4	8.2	9.34E-02	48	2.51	-4.6	18.0	7.95E-01
08066250	43626	12	1339	Most	33	-10.4	5.3	6.25E-02	46	4.98	9.0	16.4	5.82E-01
08066300	394	19	1356	Intermediate	33	6.9	5.0	1.95E-01	46	2.34	8.5	11.9	4.88E-01
08068090	2492	10	1306	Least	24	1.5	2.2	5.05E-01	27	1.54	2.2	39.7	9.55E-01
08117500	1883	9	1188	Intermediate	57	-6.1	0.6	<1.00E-06	57	14.91	1.2	7.3	8.66E-01
08123850	38617	581	549	Most	33	1.8	4.5	6.91E-01	44	0.38	-3.9	30.6	8.91E-01
08151500	10870	296	699	Intermediate	55	-8.7	1.3	<1.00E-06	62	1.05	-4.0	10.4	6.97E-01
08162000	108788	16	1206	Most	25	-16.5	9.7	1.18E-01	62	0.81	2.1	15.5	8.91E-01
08164000	2116	4	1094	Least	55	-2.3	1.2	6.50E-02	62	6.10	10.9	8.0	1.89E-01
08164300	860	49	1068	Least	48	2.6	1.7	1.45E-01	50	1.45	-9.5	11.3	4.07E-01
08164503	461	12	1122	Intermediate	32	8.0	2.2	1.16E-03	34	0.34	5.3	42.6	8.97E-01
08164600	238	9	1057	Least	37	14.0	2.6	1.74E-05	41	0.83	-3.0	19.6	8.77E-01
08175000	1422	54	928	Intermediate	49	-0.1	1.5	9.65E-01	52	2.26	-2.3	12.0	8.43E-01
08178800	490	161	819	Intermediate	46	-8.3	3.5	2.49E-02	51	0.23	4.2	20.4	8.35E-01
08183500	5473	87	760	Most	50	-9.8	1.6	2.11E-06	62	1.57	20.6	16.0	2.27E-01
08188500	10155	28	937	Most	58	-7.3	0.9	<1.00E-06	62	6.19	12.7	11.8	3.01E-01
08189200	227	5	975	Least	35	-7.2	4.7	1.39E-01	41	3.83	-8.1	15.8	6.16E-01
08194000	13393	112	600	Most	43	8.3	2.3	1.34E-03	62	3.33	-7.4	12.0	5.35E-01
08194500	20961	56	619	Intermediate	57	-3.7	0.7	<1.00E-06	62	20.31	-7.8	7.6	3.16E-01
08211520	234	-1	818	Intermediate	22	5.3	3.1	1.14E-01	39	0.75	19.5	21.8	3.82E-01
08279500	26936	1765	319	Most	23	1.7	7.6	8.20E-01	62	0.94	2.6	25.8	9.18E-01
09112500	749	2440	443	Intermediate	25	-5.4	8.5	5.28E-01	62	0.87	-26.4	25.5	3.20E-01
09128000	10285	1989	355	Most	23	-0.4	3.4	9.15E-01	62	2.30	-52.6	23.6	7.10E-02
09211200	11085	1944	197	Most	27	8.9	2.4	7.41E-04	48	1.92	-29.1	29.6	3.45E-01
10039500	6423	1845	372	Most	43	9.5	2.3	6.48E-05	62	3.02	15.7	20.4	4.71E-01
10312150	4665	1231	134	Most	25	15.0	4.7	1.65E-03	45	2.41	5.1	33.5	8.75E-01
10321000	11163	1503	257	Intermediate	57	-0.1	2.0	9.78E-01	62	3.76	7.5	20.9	7.23E-01
11348500	3706	1300	451	Intermediate	35	13.1	3.7	2.03E-03	62	0.98	-17.8	18.2	3.41E-01
12048000	404	174	765	Least	39	-9.7	4.9	6.64E-02	62	0.06	15.0	27.1	5.69E-01
12194000	7089	40	1929	Most	57	-2.4	0.8	6.50E-03	62	1.10	11.9	10.9	2.84E-01
12304500	1984	561	620	Intermediate	40	3.2	2.1	1.32E-01	55	1.54	-11.5	14.5	4.31E-01
12340000	5931	1019	492	Intermediate	50	12.8	2.8	5.26E-05	62	0.14	15.3	26.3	5.52E-01
12340500	15537	975	423	Intermediate	49	-2.3	1.8	2.12E-01	62	2.03	-4.4	16.8	7.96E-01
12344000	2717	1202	412	Intermediate	21	-48.1	11.9	4.07E-04	62	0.65	-7.7	20.6	7.02E-01
12353000	23318	940	386	Intermediate	39	2.5	2.7	3.60E-01	62	0.43	-3.9	27.1	8.81E-01
12354500	27736	793	514	Intermediate	39	4.6	3.5	1.97E-01	62	0.27	-6.7	29.7	8.11E-01
12358500	2922	954	712	Least	52	-0.1	1.5	9.66E-01	62	0.46	-15.7	17.0	3.68E-01
12363000	11562	908	432	Most	55	11.1	1.3	<1.00E-06	62	2.66	-134.0	22.1	1.40E-03
12370000	1738	933	581	Intermediate	48	1.0	1.9	5.89E-01	62	0.35	-8.7	31.0	7.62E-01
12389000	51691	746	478	Most	42	14.0	1.9	<1.00E-06	62	0.92	-30.1	21.4	1.91E-01
12401500	5698	560	521	Intermediate	36	-20.3	5.2	3.47E-04	62	0.78	6.2	13.0	6.35E-01
12422500	11111	517	452	Intermediate	48	15.4	3.5	1.27E-04	62	1.51	31.5	18.7	1.21E-01
12424000	1785	523	452	Intermediate	34	-6.8	4.4	1.38E-01	62	0.13	5.0	24.6	8.34E-01
12442500	9195	347	382	Intermediate	36	1.1	1.8	5.36E-01	62	0.57	-29.6	30.9	3.60E-01
12449950	4589	274	333	Intermediate	41	7.4	2.5	5.61E-03	52	0.38	-26.3	34.5	4.53E-01
12459000	2590	313	461	Intermediate	25	5.1	7.7	5.17E-01	62	0.17	6.6	26.3	7.92E-01
12472800	248640	119	382	Most	52	1.1	1.2	3.73E-01	62	3.32	-78.8	18.7	3.80E-03
12484500	4128	396	272	Most	61	4.2	0.6	<1.00E-06	62	0.33	28.7	19.0	1.67E-01
12510500	14543	139	216	Most	57	1.7	2.1	4.20E-01	62	0.83	3.8	15.4	8.03E-01
13037500	14898	1529	356	Most	34	-16.4	3.3	3.26E-06	62	2.17	-97.6	24.6	6.60E-03
13060000	25356	1402	300	Most	34	-3.0	2.3	2.07E-01	62	0.87	44.2	30.1	1.81E-01
13168500	6957	792	223	Intermediate	35	13.2	2.8	5.50E-05	62	0.78	1.2	30.0	9.62E-01
13247500	5750	800	444	Most	24	-11.7	4.1	8.91E-03	62	0.22	4.2	26.0	8.62E-01
13249500	7071	732	381	Most	22	8.9	3.8	2.41E-02	62	0.62	-1.5	18.6	9.42E-01
13251000	8392	652	265	Most	20	13.0	5.2	2.06E-02	62	0.22	36.0	24.2	1.77E-01
13266000	3756	672	351	Intermediate	25	22.8	4.8	4.42E-05	59	1.48	6.0	11.6	6.09E-01
14046500	13183	498	352	Intermediate	25	-6.8	2.3	6.31E-03	62	0.87	0.6	12.8	9.57E-01
14190500	622	52	1206	Intermediate	42	-4.2	2.6	1.19E-01	62	3.56	-5.9	6.3	3.60E-01
14301000	1728	10	3126	Least	62	1.5	1.9	4.56E-01	62	3.43	-1.3	6.5	8.45E-01
15024800	51593	8	1862	Least	25	-3.8	9.5	6.92E-01	35	0.22	100.1	57.3	1.40E-01

STAID	DA (km^2)	Elev. (m)	Precip. (mm/y)	Flow modification	CC length (yrs)	CC effect (%/dec)	CC effect SE (%/dec)	CC effect p	FF length (yrs)	Mean FF (d/y)	FF effect (%/dec)	FF effect SE (%/dec)	FF effect p
15258000	1642	128	1712	Intermediate	30	-4.7	2.0	2.07E-02	62	3.05	0.8	10.8	9.36E-01
15292000	15954	206	710	Least	28	-18.3	2.7	<1.00E-06	62	0.67	-18.7	20.5	3.56E-01
0208111310	280	1	1231	Least	20	1.0	5.8	8.60E-01	24	4.04	3.4	30.7	9.16E-01

STAID	$\overline{U_{FS}}$ (m/s)	$\overline{A_{FS}}$ (m^2)	$\overline{w_{FS}}$ (m)	$\overline{h_{FS}}$ (m)	$\overline{Q_{FS}}$ (m^3/s)	$\hat{Q}$ (%/dec)	$\hat{Q}$ SE (%/dec)	$\hat{Q}$ p	$\hat{A}$ (%/dec)	$\hat{A}$ SE (%/dec)	$\hat{A}$ p	$\hat{U}$ (%/dec)	$\hat{U}$ SE (%/dec)	$\hat{U}$ p	Q_{50} (m^3/s)	Q_{90} (m^3/s)
01055000	1.27	90.6	42.2	2.15	115.2	2.53	0.95	1.86E-02	2.47	0.62	1.61E-03	1.85	1.09	1.13E-01	2.5	14.7
01064500	1.66	210.1	68.4	3.07	349.1	0.68	0.76	3.88E-01	0.02	0.14	9.07E-01	0.68	0.81	4.23E-01	13.7	63.0
01098530	0.47	47.3	28.6	1.65	22.4	7.07	2.14	2.01E-03	5.85	1.36	1.12E-04	5.15	2.21	2.53E-02	4.0	12.8
01099500	1.42	61.3	38.6	1.59	86.9	0.87	1.08	4.28E-01	1.59	1.10	1.60E-01	-0.13	1.02	8.98E-01	14.8	41.5
01100000	1.90	654.9	113.7	5.76	1245.6	3.11	1.45	4.45E-02	1.45	0.52	1.15E-02	1.76	1.31	1.92E-01	165.4	509.7
01131500	1.19	425.0	132.0	3.22	504.1	0.33	0.48	5.05E-01	-0.33	0.18	8.78E-02	0.83	0.37	3.67E-02	53.7	160.6
01152500	2.11	84.8	42.1	2.01	178.9	1.32	0.59	3.55E-02	1.04	0.33	4.77E-03	-0.05	0.30	8.65E-01	6.7	28.3
01196500	0.97	82.8	39.0	2.13	80.4	-7.65	2.05	1.42E-03	-8.15	1.92	4.81E-04	-3.91	1.76	3.96E-02	4.6	12.0
01350355	2.04	281.4	105.9	2.66	574.4	-5.37	2.04	1.94E-02	-4.14	0.97	8.95E-04	-2.43	2.88	4.14E-01	3.7	42.1
01357500	3.13	738.6	190.6	3.88	2314.5	-1.72	0.97	8.66E-02	0.54	0.33	1.15E-01	-2.04	0.99	4.82E-02	98.6	382.3
01364500	1.74	118.4	33.7	3.51	206.1	0.22	0.90	8.09E-01	-0.08	0.44	8.64E-01	-0.31	0.82	7.11E-01	5.9	32.3
01389500	1.52	120.1	41.0	2.93	183.0	2.56	0.45	<1.00E-06	-0.15	0.24	5.21E-01	2.52	0.44	<1.00E-06	16.7	69.7
01420500	2.25	122.4	59.4	2.06	275.3	-0.37	0.48	4.52E-01	-0.40	0.27	1.55E-01	-0.51	0.45	2.65E-01	9.2	33.8
01426500	1.69	198.4	68.1	2.91	335.1	0.31	0.38	4.30E-01	-0.09	0.18	6.46E-01	0.29	0.36	4.29E-01	15.6	55.5
01447800	2.31	101.0	55.4	1.82	233.2	-0.85	0.66	2.10E-01	-1.30	0.42	4.57E-03	0.77	0.40	6.14E-02	11.8	36.7
01465500	1.35	136.7	64.5	2.12	184.1	-0.33	1.29	8.05E-01	-2.04	1.13	1.02E-01	1.62	0.78	6.27E-02	4.1	16.8
01477000	1.15	56.4	27.0	2.09	64.7	3.42	0.86	1.21E-03	1.32	0.50	2.02E-02	3.23	0.67	2.92E-04	1.9	4.4
01478000	0.57	57.5	25.9	2.22	32.9	-14.59	3.61	3.76E-04	-4.54	2.21	4.96E-02	-14.42	3.43	2.57E-04	0.4	1.2
01479000	0.90	85.9	35.1	2.45	77.4	4.42	1.73	2.17E-02	-1.54	1.72	3.87E-01	4.27	2.07	5.85E-02	2.3	5.0
01480870	0.84	61.7	39.4	1.57	51.8	-1.57	1.43	2.86E-01	-0.88	1.50	5.65E-01	-1.25	1.18	3.03E-01	2.7	7.1
01503000	1.49	434.9	134.3	3.24	649.6	2.15	0.55	3.80E-04	1.09	0.43	1.63E-02	1.27	0.43	5.95E-03	60.2	238.7
01509000	1.01	108.7	57.0	1.91	110.2	-1.62	0.49	3.51E-03	-0.90	0.38	2.92E-02	-1.66	0.51	3.65E-03	8.2	30.7
01512500	1.84	312.9	115.4	2.71	575.9	-0.17	0.19	3.72E-01	-0.14	0.12	2.61E-01	-0.07	0.16	6.53E-01	36.8	168.8
01531500	1.71	1505.9	249.7	6.03	2574.3	-2.54	0.91	1.54E-02	0.33	0.88	7.18E-01	-2.94	1.00	1.26E-02	163.0	757.5
01533400	1.84	1772.9	322.9	5.49	3273.9	0.39	0.57	5.06E-01	0.33	0.28	2.51E-01	-0.23	0.38	5.53E-01	193.4	835.3
01554000	1.81	4035.7	719.9	5.61	7288.8	-0.03	0.76	9.66E-01	-0.47	0.41	2.69E-01	0.35	0.47	4.73E-01	453.1	1761.3
01560000	1.25	72.6	33.4	2.17	90.6	0.77	0.74	3.18E-01	0.42	0.76	5.97E-01	0.93	0.86	3.01E-01	2.7	15.2
01568000	1.49	114.6	36.5	3.14	170.7	0.22	1.59	8.92E-01	0.51	0.99	6.19E-01	-0.04	1.59	9.82E-01	4.2	16.8
01571500	0.87	76.6	38.1	2.01	66.8	0.74	0.61	2.51E-01	-1.00	0.44	3.91E-02	0.01	0.84	9.90E-01	6.1	13.6
01604500	1.20	66.9	41.7	1.60	80.5	-2.28	0.79	1.24E-02	-0.64	0.57	2.77E-01	-1.89	0.89	5.56E-02	1.6	11.9
01638500	1.44	1775.4	390.5	4.55	2548.1	-1.04	1.13	3.79E-01	0.28	0.15	1.03E-01	-1.13	0.98	2.83E-01	151.0	547.9
02029000	1.69	1139.0	231.0	4.93	1926.4	0.26	0.34	4.52E-01	0.03	0.19	8.58E-01	0.41	0.25	1.18E-01	85.8	303.0
02035000	1.51	1370.6	245.3	5.59	2063.8	-0.22	0.39	5.79E-01	-0.45	0.50	3.92E-01	0.52	0.37	1.86E-01	113.4	406.3
02039500	0.63	177.4	86.4	2.05	112.3	1.51	1.30	2.63E-01	-1.56	0.76	5.88E-02	2.04	0.96	5.14E-02	4.5	13.6
02049500	0.47	197.8	46.4	4.26	92.2	-3.22	0.53	<1.00E-06	-1.23	0.15	<1.00E-06	-2.13	0.56	2.05E-04	9.9	44.2
02066000	1.05	453.1	88.1	5.14	474.8	-0.42	0.69	5.47E-01	-0.40	0.35	2.62E-01	-0.39	0.73	5.97E-01	51.5	145.0
02071000	1.26	361.2	100.2	3.61	456.4	2.56	0.85	1.07E-02	1.22	0.70	1.08E-01	2.04	0.90	4.51E-02	23.3	52.5
02075500	1.32	399.1	82.7	4.83	526.8	1.25	0.49	1.74E-02	1.81	0.48	7.88E-04	-0.20	0.48	6.76E-01	52.4	131.4
02082585	0.92	291.0	65.7	4.43	267.2	0.23	0.94	8.11E-01	0.64	0.85	4.55E-01	-0.10	0.93	9.13E-01	11.7	50.4
02082950	0.70	120.1	51.1	2.35	84.0	-3.16	0.57	1.67E-06	-0.26	0.28	3.63E-01	-3.11	0.57	2.60E-06	2.1	9.2
02083500	0.68	424.8	115.4	3.68	288.6	-0.87	0.45	6.74E-02	-0.55	0.21	1.73E-02	-0.93	0.44	4.39E-02	31.7	148.8
02088000	0.86	85.2	33.5	2.54	73.2	1.28	1.05	2.35E-01	0.77	0.65	2.53E-01	1.18	1.08	2.88E-01	1.3	5.2
02088500	0.62	106.8	44.3	2.41	66.5	0.69	0.68	3.16E-01	-0.07	0.30	8.28E-01	0.57	0.57	3.30E-01	2.9	15.7
02089000	0.71	367.0	90.6	4.05	261.5	-0.37	0.33	2.63E-01	0.43	0.28	1.34E-01	-0.42	0.37	2.65E-01	36.2	153.1
02089500	0.67	294.3	79.9	3.68	198.4	-0.17	0.55	7.57E-01	0.06	0.34	8.58E-01	-0.20	0.58	7.29E-01	44.7	168.1
02096960	1.48	281.7	93.7	3.01	418.0	2.41	0.52	1.17E-04	0.74	0.43	1.02E-01	2.63	0.49	2.38E-05	14.3	67.1
02104220	0.42	29.9	28.1	1.07	12.7	5.03	0.82	<1.00E-06	1.28	0.69	6.94E-02	5.21	0.87	<1.00E-06	2.6	4.9
02106500	0.74	190.5	48.1	3.96	140.1	-2.59	0.65	1.59E-04	0.90	0.18	4.58E-06	-3.15	0.69	1.88E-05	14.2	45.7
02131000	0.28	2412.4	1520.1	1.59	671.2	-1.07	1.24	4.03E-01	-1.94	1.01	7.47E-02	0.78	1.04	4.67E-01	199.8	518.2
02132000	0.81	182.1	58.3	3.12	148.0	0.40	0.32	2.18E-01	0.26	0.27	3.32E-01	0.35	0.32	2.77E-01	18.7	56.1
02175000	0.61	249.6	81.7	3.06	153.1	-0.18	0.29	5.30E-01	-0.39	0.18	2.89E-02	-0.28	0.29	3.37E-01	43.9	121.9
02215500	0.88	779.9	286.3	2.72	686.3	-0.27	0.40	5.09E-01	0.17	0.31	5.82E-01	-0.25	0.38	5.08E-01	94.4	312.9
02217500	1.37	214.7	58.3	3.68	294.7	2.02	0.67	7.25E-03	2.28	0.64	2.42E-03	1.01	0.65	1.39E-01	10.3	25.0
02223500	1.29	499.5	90.7	5.51	645.2	-2.22	0.41	2.11E-06	-0.79	0.32	1.60E-02	-2.05	0.40	7.20E-06	69.1	271.3
02225500	0.54	145.2	44.1	3.29	78.9	-3.70	0.25	<1.00E-06	-0.97	0.29	1.16E-03	-3.69	0.27	<1.00E-06	8.5	73.2
02226500	0.27	687.7	354.3	1.94	188.1	0.65	0.50	2.06E-01	-0.31	0.21	1.44E-01	0.73	0.54	1.85E-01	8.6	80.4
02228000	0.27	562.7	480.9	1.17	152.0	1.14	0.40	8.06E-03	0.38	0.37	3.06E-01	1.11	0.40	8.91E-03	22.1	158.4
02231000	0.36	198.9	52.9	3.76	71.8	-0.39	0.56	4.81E-01	-0.93	0.45	4.25E-02	-0.09	0.56	8.66E-01	6.3	36.7
02295637	0.75	136.1	38.9	3.50	101.8	0.17	1.71	9.22E-01	-2.88	1.70	1.09E-01	-0.85	1.90	6.62E-01	8.3	31.4
02297310	0.24	169.5	100.7	1.68	40.0	-10.27	0.84	<1.00E-06	-8.55	0.72	<1.00E-06	-6.39	1.35	1.69E-05	1.1	12.5
02298830	0.15	127.8	56.0	2.28	19.8	-4.38	1.76	1.53E-02	2.70	0.22	<1.00E-06	-7.60	2.90	1.08E-02	2.1	16.5
02299950	0.26	84.3	41.6	2.03	21.6	-6.06	1.61	7.17E-04	-2.61	1.43	7.82E-02	-5.57	1.55	1.15E-03	0.5	5.1
02300500	0.33	91.5	57.8	1.58	30.0	-8.02	2.98	1.54E-02	-8.88	1.33	5.52E-06	-1.92	5.15	7.14E-01	1.8	9.9
02312000	0.24	186.5	97.4	1.91	44.6	-2.40	0.62	3.32E-04	-2.16	0.23	<1.00E-06	-1.03	0.91	2.62E-01	2.7	16.0
02312500	0.29	192.3	58.8	3.27	56.5	-3.84	1.78	4.45E-02	-1.08	0.64	1.10E-01	-3.79	1.81	5.13E-02	4.5	20.4
02313000	0.48	180.8	82.0	2.21	86.7	-0.14	0.36	7.04E-01	-0.38	0.37	3.11E-01	0.27	0.32	4.10E-01	18.2	41.2
02315500	0.59	445.1	76.9	5.79	260.3	-3.66	0.67	9.58E-06	-3.16	0.81	6.35E-04	-2.99	0.82	1.22E-03	18.8	108.7
02317500	0.52	391.6	130.9	2.99	202.2	0.81	0.31	1.01E-02	0.22	0.30	4.73E-01	0.90	0.31	4.33E-03	9.6	77.7
02323500	0.82	823.0	134.7	6.11	673.7	1.74	0.50	8.67E-04	1.20	0.36	1.54E-03	1.42	0.50	5.87E-03	211.6	403.5
02326000	0.47	56.3	24.4	2.30	26.7	1.33	0.31	8.30E-05	0.81	0.26	3.89E-03	1.27	0.31	1.92E-04	1.6	9.6
02327100	0.62	111.6	28.1	3.97	69.3	-0.13	0.54	8.18E-01	0.46	0.37	2.45E-01	-0.34	0.63	6.00E-01	1.3	13.4
02329000	0.37	306.4	177.4	1.73	114.3	1.14	0.62	7.70E-02	-0.28	0.50	5.74E-01	0.85	0.70	2.34E-01	12.4	64.6
02336000	1.07	331.9	84.0	3.95	354.4	-7.31	3.60	5.30E-02	4.39	1.04	3.04E-04	-13.20	2.57	2.94E-05	56.6	134.6
02339500	1.34	801.9	183.9	4.36	1076.2	1.07	0.58	8.55E-02	0.88	0.54	1.28E-01	0.47	0.43	2.90E-01	119.2	277.8
02344350	0.68	105.4	52.3	2.02	71.6	9.59	0.60	<1.00E-06	7.53	0.80	<1.00E-06	9.90	0.93	<1.00E-06	2.4	10.3
02344700	0.43	122.1	48.5	2.52	52.3	3.48	1.06	2.53E-03	4.60	1.07	1.55E-04	1.72	1.36	2.16E-01	2.0	7.9
02347500	1.22	425.8	87.2	4.88	518.2	1.39	0.60	2.76E-02	0.60	0.60	3.23E-01	1.72	0.51	2.61E-03	35.2	128.7

STAID	$\overline{U_{FS}}$ (m/s)	$\overline{A_{FS}}$ (m^2)	$\overline{w_{FS}}$ (m)	$\overline{h_{FS}}$ (m)	$\overline{Q_{FS}}$ (m^3/s)	$\hat{Q}$ (%/dec)	$\hat{Q}$ SE (%/dec)	$\hat{Q}$ p	$\hat{A}$ (%/dec)	$\hat{A}$ SE (%/dec)	$\hat{A}$ p	$\hat{U}$ (%/dec)	$\hat{U}$ SE (%/dec)	$\hat{U}$ p	Q_{50} (m^3/s)	Q_{90} (m^3/s)
02352500	1.22	963.2	234.2	4.11	1173.6	-0.93	0.63	1.64E-01	-0.37	0.23	1.42E-01	-1.04	0.68	1.49E-01	105.8	349.7
02353000	0.97	1008.5	206.4	4.89	977.8	1.89	0.60	6.42E-03	2.09	0.42	1.91E-04	2.00	0.81	2.78E-02	126.0	351.1
02359000	0.98	175.1	35.0	5.00	171.0	0.19	0.49	6.93E-01	0.05	0.27	8.51E-01	0.20	0.49	6.79E-01	29.9	72.6
02366500	0.29	1798.9	686.7	2.62	525.3	-0.42	0.55	4.65E-01	-0.09	0.55	8.78E-01	-0.11	0.61	8.59E-01	126.2	375.2
02368000	0.37	1004.1	467.0	2.15	376.5	0.15	0.73	8.36E-01	0.56	0.61	3.66E-01	0.10	0.48	8.35E-01	19.0	57.3
02383500	0.79	401.6	122.6	3.27	317.5	2.34	1.41	1.20E-01	0.23	0.39	5.64E-01	1.66	1.34	2.35E-01	29.7	79.4
02384500	0.74	186.7	106.5	1.75	137.6	0.87	2.36	7.19E-01	3.10	2.20	1.83E-01	-2.35	1.98	2.58E-01	6.9	28.1
02385800	0.89	111.3	60.6	1.84	99.5	1.24	1.68	4.68E-01	4.86	1.00	4.95E-05	-3.60	2.05	9.12E-02	1.4	6.8
02397000	1.14	686.5	90.5	7.59	784.3	-0.62	0.70	3.84E-01	-0.71	0.28	1.42E-02	-0.83	0.71	2.46E-01	122.5	385.1
02398000	0.77	172.4	105.3	1.64	133.4	-0.09	1.09	9.34E-01	0.16	0.48	7.47E-01	0.04	1.19	9.74E-01	5.0	19.4
02431000	1.00	674.5	260.2	2.59	679.1	-8.88	1.80	1.23E-04	-4.22	1.17	2.37E-03	-8.27	1.85	3.83E-04	10.1	53.7
02439400	0.52	220.9	76.5	2.89	114.6	0.73	0.55	1.93E-01	0.50	0.66	4.53E-01	1.43	0.57	1.51E-02	20.5	83.8
02456500	0.97	531.8	89.1	5.97	516.4	2.00	1.28	1.41E-01	-0.04	0.50	9.45E-01	2.06	1.31	1.42E-01	16.1	91.9
02473000	1.26	765.0	135.4	5.65	959.9	0.26	0.99	7.97E-01	0.21	1.01	8.43E-01	0.34	0.86	7.00E-01	35.4	163.7
02474500	1.15	242.9	72.4	3.35	281.0	5.93	0.72	<1.00E-06	1.85	0.64	5.60E-03	5.91	0.75	<1.00E-06	8.7	63.7
02478500	0.95	329.1	65.1	5.06	312.0	3.13	1.06	5.47E-03	1.83	0.72	1.51E-02	3.02	0.94	2.62E-03	48.4	265.6
02479560	0.90	399.9	148.8	2.69	358.7	-0.03	1.28	9.82E-01	0.14	1.16	9.03E-01	-0.42	1.15	7.22E-01	15.3	70.7
02481880	0.19	340.6	179.9	1.89	63.9	-1.03	2.39	6.70E-01	-0.07	1.11	9.47E-01	-0.99	2.41	6.86E-01	4.3	44.7
02482000	0.68	230.8	48.9	4.72	157.4	6.47	0.83	<1.00E-06	0.14	0.90	8.77E-01	6.98	0.99	<1.00E-06	9.6	83.4
02482550	0.40	487.5	177.8	2.74	194.0	2.79	1.50	6.87E-02	-0.48	1.54	7.56E-01	5.21	1.45	7.39E-04	19.4	124.9
02483000	0.57	147.8	39.7	3.72	83.8	1.28	2.74	6.46E-01	-4.74	2.24	4.69E-02	2.16	3.18	5.06E-01	3.2	40.8
02484000	0.67	270.3	165.6	1.63	181.0	-1.13	1.65	5.01E-01	0.86	0.87	3.33E-01	-2.10	1.54	1.84E-01	2.6	35.7
02488500	1.02	728.1	142.3	5.12	742.6	4.08	0.71	<1.00E-06	1.03	0.42	1.72E-02	4.04	0.68	<1.00E-06	66.3	515.4
03015000	1.98	130.3	61.9	2.10	258.7	-1.77	0.43	5.76E-04	-1.59	0.46	2.99E-03	-1.00	0.34	9.20E-03	28.8	107.0
03094000	1.09	102.0	44.7	2.28	111.2	0.14	0.38	7.12E-01	0.57	0.26	3.77E-02	-0.44	0.36	2.22E-01	9.8	40.2
03155000	1.42	782.2	108.3	7.23	1108.0	-0.64	0.48	1.93E-01	-0.37	0.19	5.69E-02	-0.45	0.49	3.63E-01	24.6	149.2
03179000	1.99	84.7	33.3	2.55	168.2	0.65	0.26	1.97E-02	0.37	0.24	1.33E-01	0.66	0.25	1.21E-02	5.8	30.6
03200500	1.62	391.9	84.6	4.63	634.8	-4.66	0.78	2.40E-05	-0.81	0.68	2.52E-01	-4.67	0.84	6.62E-05	17.8	73.5
03212500	0.84	1024.7	147.3	6.96	864.2	-0.77	1.79	6.71E-01	-0.43	0.42	3.15E-01	0.25	1.44	8.63E-01	31.1	160.6
03213700	1.30	409.4	62.3	6.57	534.1	4.10	1.36	7.35E-03	2.61	0.64	6.91E-04	2.65	1.63	1.21E-01	16.7	67.0
03237500	1.45	253.0	64.8	3.90	367.7	-0.84	0.67	2.30E-01	0.35	0.28	2.32E-01	-0.80	0.54	1.59E-01	3.2	27.6
03263000	1.31	395.3	99.1	3.99	516.7	-2.19	1.07	6.63E-02	-1.78	1.52	2.69E-01	0.63	1.07	5.65E-01	12.3	67.4
03282000	1.45	864.1	98.9	8.74	1250.1	0.12	0.48	8.04E-01	0.32	0.46	5.00E-01	-0.32	0.43	4.69E-01	41.6	257.1
03308500	1.07	555.5	91.9	6.04	595.4	1.82	0.49	1.15E-03	-0.58	0.49	2.46E-01	1.82	0.60	6.30E-03	34.0	190.6
03322900	0.90	108.7	60.8	1.79	98.4	-0.31	0.83	7.16E-01	0.19	0.58	7.46E-01	-0.46	0.86	6.02E-01	3.3	34.0
03331500	0.50	181.7	77.7	2.34	91.9	-6.88	1.90	1.31E-03	-0.98	0.71	1.80E-01	-6.90	1.98	1.92E-03	18.3	52.1
03333450	0.59	99.1	46.9	2.12	58.3	-2.16	2.01	3.07E-01	-1.72	1.16	1.70E-01	-0.48	1.73	7.87E-01	1.3	9.5
03335500	0.86	578.4	179.5	3.22	498.0	-0.93	0.45	4.55E-02	-1.22	0.44	8.43E-03	-0.53	0.43	2.26E-01	112.8	468.6
03336000	0.91	602.6	135.5	4.45	545.4	-3.22	0.93	1.52E-03	-0.50	0.59	4.01E-01	-3.64	0.83	1.25E-04	138.4	525.3
03339000	1.27	335.3	90.6	3.70	427.1	6.81	0.99	5.35E-06	5.62	0.71	1.52E-06	6.55	1.49	6.23E-04	13.1	70.8
03340500	0.82	714.4	186.9	3.82	584.0	-0.91	0.82	2.83E-01	1.63	0.67	2.74E-02	-0.63	1.27	6.30E-01	185.1	733.4
03341500	0.80	918.1	178.9	5.13	736.8	0.65	0.56	2.58E-01	0.00	0.35	1.00E+00	0.60	0.48	2.28E-01	206.9	825.4
03342000	0.95	800.3	173.9	4.60	760.6	-2.24	0.28	<1.00E-06	-1.78	0.25	<1.00E-06	-1.66	0.24	<1.00E-06	225.1	872.2
03343400	0.30	111.9	50.3	2.23	33.6	0.05	1.55	9.73E-01	0.10	0.80	9.04E-01	-0.23	1.41	8.74E-01	1.7	11.2
03345500	1.30	211.9	48.9	4.34	274.5	8.33	1.13	<1.00E-06	-0.26	1.04	8.07E-01	9.48	1.10	<1.00E-06	14.1	85.0
03346000	0.70	289.9	124.2	2.33	202.7	-0.47	1.76	7.91E-01	-3.09	1.05	9.08E-03	1.68	2.03	4.19E-01	1.4	16.7
03347000	1.34	83.2	51.4	1.62	110.8	2.44	2.15	2.81E-01	0.31	0.99	7.60E-01	1.06	1.76	5.59E-01	2.6	15.1
03351310	0.98	33.3	28.6	1.17	32.8	6.62	4.00	1.22E-01	1.13	4.12	7.88E-01	7.41	2.89	2.47E-02	0.2	1.1
03352500	0.79	149.4	87.4	1.71	117.8	-0.93	1.43	5.30E-01	-1.87	1.62	2.79E-01	0.62	1.69	7.24E-01	4.4	20.1
03353600	1.64	15.7	14.1	1.11	25.7	3.17	2.40	2.11E-01	4.73	2.42	7.65E-02	1.41	2.85	6.32E-01	0.2	1.6
03358000	1.10	111.2	34.4	3.24	122.6	1.89	1.19	1.34E-01	1.97	1.13	1.04E-01	0.41	0.86	6.42E-01	2.4	16.2
03360500	1.13	386.8	92.4	4.19	438.3	-0.56	0.99	5.76E-01	0.31	0.75	6.84E-01	-0.78	0.97	4.29E-01	83.4	334.1
03361650	0.67	59.5	38.4	1.55	39.9	3.62	1.55	3.23E-02	0.96	0.91	3.08E-01	2.91	1.52	7.41E-02	1.3	7.5
03361850	0.79	54.1	30.0	1.81	42.7	0.80	1.48	5.98E-01	0.67	1.65	6.93E-01	1.38	1.00	1.94E-01	1.0	6.3
03362500	0.96	131.7	59.9	2.20	126.2	3.04	3.08	3.46E-01	-0.28	3.27	9.33E-01	1.72	3.20	6.04E-01	6.7	33.7
03371500	0.85	584.2	124.5	4.69	499.0	-2.21	0.63	1.37E-03	-0.60	0.52	2.61E-01	-1.67	0.63	1.25E-02	68.7	297.3
03374000	0.97	886.9	183.4	4.83	860.0	-0.45	0.84	6.01E-01	0.32	0.54	5.55E-01	0.04	0.85	9.68E-01	233.8	816.9
03376500	0.81	132.2	32.7	4.04	106.6	4.06	1.02	2.61E-04	5.97	0.60	<1.00E-06	0.30	1.45	8.34E-01	14.2	73.9
03377500	1.05	1992.7	308.6	6.46	2088.4	-0.09	0.51	8.62E-01	0.06	0.51	9.09E-01	-0.09	0.52	8.60E-01	533.8	1888.7
03379500	0.60	135.0	34.8	3.88	81.1	-4.14	1.90	4.18E-02	-6.33	1.88	3.50E-03	-1.58	2.24	4.89E-01	4.2	81.3
03403500	0.88	473.0	74.5	6.35	418.6	0.87	1.38	5.36E-01	0.52	0.35	1.56E-01	0.22	1.44	8.79E-01	21.5	105.8
03436100	0.85	584.9	118.2	4.95	495.6	0.00	0.45	9.97E-01	-0.79	0.40	8.01E-02	0.03	0.66	9.64E-01	16.7	83.0
03443000	0.67	160.5	51.1	3.14	107.7	-1.19	0.54	3.34E-02	-0.38	0.39	3.40E-01	-1.15	0.56	4.56E-02	23.1	48.8
03451500	1.96	301.4	115.5	2.61	589.6	-0.20	0.24	4.22E-01	-0.15	0.14	3.06E-01	-0.24	0.30	4.34E-01	46.7	100.2
03453500	1.96	300.4	102.2	2.94	588.5	1.96	0.52	1.30E-03	0.58	0.39	1.57E-01	1.99	0.40	8.53E-05	55.2	120.8
03455000	1.58	414.3	119.7	3.46	657.0	1.80	1.17	1.51E-01	-0.77	0.63	2.49E-01	2.02	0.84	3.82E-02	67.4	154.9
03524000	1.30	229.0	63.9	3.59	297.6	0.56	1.59	7.34E-01	-0.12	0.66	8.56E-01	0.45	1.75	8.05E-01	10.9	42.1
03575000	1.29	361.4	116.7	3.10	465.3	3.11	1.12	1.21E-02	-1.06	1.19	3.85E-01	4.45	1.37	4.40E-03	7.3	30.6
04024000	0.83	669.0	139.0	4.81	557.8	-1.48	0.47	4.24E-03	0.38	0.31	2.30E-01	-1.62	0.48	2.56E-03	41.2	153.1
04041500	1.37	59.7	37.1	1.61	81.7	-1.03	1.62	5.32E-01	-1.74	0.97	9.01E-02	0.79	1.43	5.86E-01	7.1	21.6
04062500	1.35	79.4	45.7	1.74	107.5	1.84	0.59	5.99E-03	1.68	0.66	2.23E-02	1.00	0.46	4.38E-02	17.7	32.3
04073500	0.66	144.2	49.8	2.90	95.5	-3.04	0.23	<1.00E-06	-0.38	0.10	2.95E-04	-3.05	0.23	<1.00E-06	25.7	60.3
04079000	0.69	292.9	70.0	4.18	201.3	-2.37	0.46	2.76E-06	-1.89	0.16	<1.00E-06	-1.24	0.72	9.07E-02	35.1	95.0
04085427	1.52	62.7	30.5	2.06	95.6	0.40	1.04	7.03E-01	-1.63	0.63	1.50E-02	0.45	1.30	7.33E-01	3.1	23.0
04087204	1.60	14.9	8.9	1.68	23.8	5.82	2.49	2.93E-02	0.14	0.81	8.67E-01	6.12	2.51	2.41E-02	0.2	1.6
04087240	1.94	44.9	29.7	1.51	87.1	-1.10	0.65	1.09E-01	-0.95	0.77	2.31E-01	-0.74	0.38	6.51E-02	1.6	12.7
04099750	0.75	41.3	31.1	1.33	31.2	-3.22	2.93	2.90E-01	-1.08	0.43	2.59E-02	-0.99	3.47	7.79E-01	8.4	18.9
04101500	1.26	258.9	77.9	3.32	327.2	-0.38	0.26	1.45E-01	-1.15	0.11	<1.00E-06	0.61	0.34	7.53E-02	90.6	180.9
04106000	1.02	119.8	44.5	2.69	122.2	-0.71	0.95	4.68E-01	-0.92	0.62	1.56E-01	-0.83	1.01	4.25E-01	23.2	43.6
04113000	1.01	181.9	66.3	2.75	184.2	-0.45	0.26	8.99E-02	-0.89	0.22	1.46E-04	0.26	0.26	3.21E-01	18.4	55.6
04115000	0.50	104.6	57.3	1.82	52.7	-9.49	1.19	<1.00E-06	-7.32	0.88	<1.00E-06	-7.39	1.45	3.56E-06	4.0	18.5
04116000	1.07	419.1	109.2	3.84	450.3	-0.81	0.41	5.51E-02	0.12	0.16	4.58E-01	-0.82	0.40	4.64E-02	38.5	122.6
04119000	1.34	581.8	133.3	4.36	777.4	-0.81	0.44	8.68E-02	0.72	0.24	1.11E-02	-1.67	0.36	5.05E-04	83.1	214.8
04121500	1.31	111.8	47.2	2.37	146.6	-0.79	0.52	1.41E-01	-0.51	0.33	1.33E-01	-0.66	0.55	2.39E-01	23.9	58.3
04122500	0.77	98.8	37.5	2.63	76.3	2.39	1.13	4.51E-02	3.10	1.02	6.17E-03	1.43	1.27	2.73E-01	18.5	30.4
04142000	0.88	46.3	27.1	1.71	40.9	2.19	1.39	1.35E-01	-0.99	0.66	1.53E-01	3.05	1.58	7.47E-02	6.6	16.2
04144500	1.06	66.9	42.4	1.58	70.7	0.42	1.00	6.79E-01	-1.27	0.57	3.54E-02	1.94	1.05	7.53E-02	6.8	23.4
04151500	0.51	330.0	91.7	3.60	169.0	0.72	0.69	3.12E-01	0.61	0.43	1.81E-01	0.70	0.75	3.64E-01	6.0	35.5

STAID	$\overline{U_{FS}}$ (m/s)	$\overline{A_{FS}}$ (m^2)	$\overline{w_{FS}}$ (m)	$\overline{h_{FS}}$ (m)	$\overline{Q_{FS}}$ (m^3/s)	$\hat{Q}$ (%/dec)	$\hat{Q}$ SE (%/dec)	$\hat{Q}$ p	$\hat{A}$ (%/dec)	$\hat{A}$ SE (%/dec)	$\hat{A}$ p	$\hat{U}$ (%/dec)	$\hat{U}$ SE (%/dec)	$\hat{U}$ p	Q_{50} (m^3/s)	Q_{90} (m^3/s)
04154000	0.87	58.0	29.8	1.95	50.2	-0.67	0.82	4.23E-01	0.63	0.39	1.23E-01	-0.65	0.93	4.94E-01	7.6	17.1
04164000	0.91	120.7	41.7	2.90	109.4	1.76	2.00	3.97E-01	-0.84	1.10	4.63E-01	2.05	2.21	3.75E-01	8.4	21.6
04168000	0.98	35.3	15.4	2.30	34.5	-0.59	0.86	4.98E-01	-1.01	0.35	6.44E-03	1.08	0.64	1.01E-01	0.6	4.0
04178000	0.53	128.2	47.8	2.68	68.0	-4.79	1.16	1.71E-04	0.17	0.52	7.45E-01	-5.04	1.23	1.83E-04	6.6	40.8
04181500	0.64	155.3	51.3	3.03	99.8	0.75	0.70	2.97E-01	0.53	0.57	3.64E-01	0.66	0.71	3.62E-01	3.8	40.6
04182000	0.86	235.0	65.7	3.58	201.7	-0.45	1.02	6.69E-01	-0.51	0.91	5.82E-01	0.01	0.71	9.86E-01	4.7	53.2
04183000	0.92	359.0	94.9	3.78	328.5	-1.01	0.55	8.88E-02	-0.97	0.38	2.60E-02	-1.47	0.53	1.58E-02	22.1	141.6
04186500	0.88	124.7	43.7	2.86	109.1	1.81	0.84	4.75E-02	-0.63	0.31	5.92E-02	1.78	0.89	6.42E-02	1.9	18.3
04193500	1.72	574.3	244.3	2.35	987.0	5.17	1.49	1.79E-03	2.47	0.66	1.00E-03	3.86	1.40	1.06E-02	56.6	413.4
04201500	1.77	74.8	47.9	1.56	132.4	-0.05	2.41	9.83E-01	-1.68	2.66	5.40E-01	1.77	2.67	5.20E-01	2.9	19.7
04229500	2.90	24.2	19.1	1.27	70.2	-2.10	3.57	5.64E-01	2.33	2.45	3.55E-01	-0.85	3.83	8.27E-01	1.5	8.2
04230500	1.37	42.0	25.7	1.63	57.7	3.05	2.17	1.72E-01	-0.26	0.48	5.91E-01	3.51	1.81	6.47E-02	3.1	14.2
04282000	1.13	86.7	29.9	2.90	97.6	-0.44	0.71	5.48E-01	1.64	0.92	9.57E-02	-2.06	0.98	5.52E-02	10.4	34.3
04293500	2.00	167.3	43.4	3.85	334.3	2.48	1.41	1.04E-01	2.04	0.35	1.22E-04	1.36	1.19	2.78E-01	14.0	62.2
05059700	0.62	72.9	39.7	1.83	45.3	10.38	1.84	1.73E-06	7.52	1.48	1.09E-05	9.12	2.05	7.85E-05	0.1	2.3
05062000	0.66	39.1	11.0	3.54	25.9	7.66	0.68	<1.00E-06	0.52	0.24	3.51E-02	7.64	0.68	<1.00E-06	1.4	10.6
05064500	0.76	649.7	122.5	5.30	495.3	3.46	1.37	1.66E-02	0.00	0.68	9.98E-01	3.88	1.37	7.63E-03	26.0	137.8
05066500	0.55	176.0	53.3	3.30	96.0	5.55	2.65	4.91E-02	-0.83	1.66	6.23E-01	5.02	2.98	1.08E-01	0.3	4.8
05079000	1.11	216.7	61.0	3.55	240.8	0.04	0.37	9.11E-01	-1.09	0.22	8.07E-06	0.56	0.38	1.48E-01	29.0	75.3
05082500	0.92	541.7	94.3	5.74	497.6	7.27	1.40	1.59E-06	6.60	0.48	<1.00E-06	11.23	1.89	<1.00E-06	54.8	257.3
05227500	0.51	244.3	59.0	4.14	124.2	-1.26	0.61	4.61E-02	-1.16	0.42	9.61E-03	-0.74	0.62	2.40E-01	64.8	160.7
05280000	0.98	173.2	73.4	2.36	169.0	1.95	0.44	1.29E-04	1.25	0.30	2.53E-04	1.49	0.49	5.02E-03	9.3	69.1
05330000	1.42	593.2	93.9	6.32	841.8	2.64	1.29	5.17E-02	1.02	0.74	1.81E-01	2.79	1.33	4.68E-02	62.1	345.5
05374000	1.47	217.4	69.7	3.12	319.0	2.67	0.74	2.10E-03	2.48	0.64	1.32E-03	1.22	0.69	9.69E-02	7.9	28.0
05382000	1.07	405.5	135.5	2.99	432.9	-2.11	0.59	1.00E-03	-1.69	0.50	1.61E-03	-2.00	0.63	2.86E-03	24.9	111.4
05404000	1.27	924.8	173.5	5.33	1172.9	8.39	0.46	<1.00E-06	4.16	0.73	<1.00E-06	4.66	0.58	<1.00E-06	142.9	315.7
05412500	1.41	201.9	55.6	3.63	285.0	-5.39	0.57	<1.00E-06	-1.73	0.50	8.10E-04	-4.42	0.45	<1.00E-06	17.1	62.4
05413500	0.68	111.3	32.7	3.40	75.3	8.22	1.15	<1.00E-06	1.33	0.96	1.74E-01	8.32	1.14	<1.00E-06	3.7	6.5
05430500	0.98	199.8	88.8	2.25	195.2	-1.96	0.45	9.88E-05	-0.08	0.26	7.61E-01	-2.15	0.44	2.00E-05	47.9	120.1
05437500	1.00	443.0	163.8	2.70	442.0	0.29	0.58	6.13E-01	-0.37	0.34	2.78E-01	0.41	0.55	4.61E-01	109.2	242.1
05439000	0.82	43.9	25.0	1.76	36.2	0.36	3.09	9.10E-01	-4.79	1.10	3.01E-04	8.05	3.48	3.12E-02	0.8	4.4
05446500	0.76	687.0	275.1	2.50	523.3	-0.71	0.34	4.11E-02	-0.86	0.30	5.19E-03	-0.36	0.33	2.81E-01	160.3	351.1
05449500	1.02	111.7	44.3	2.52	113.4	-1.61	0.56	4.73E-03	1.58	0.45	6.95E-04	-2.67	0.60	2.01E-05	3.0	15.7
05451500	0.96	382.7	144.2	2.65	366.2	-8.71	1.17	<1.00E-06	-9.63	0.98	<1.00E-06	-3.01	0.96	2.74E-03	12.8	57.1
05451900	0.74	73.1	29.9	2.44	53.8	-2.47	1.67	1.52E-01	-2.57	1.31	6.27E-02	-1.16	1.68	4.97E-01	0.5	2.0
05453100	0.75	216.7	77.5	2.80	163.2	1.72	0.33	<1.00E-06	1.56	0.30	<1.00E-06	1.72	0.33	<1.00E-06	26.7	113.8
05455500	1.11	115.8	40.6	2.85	128.0	-3.49	0.38	<1.00E-06	-1.28	0.27	6.99E-06	-3.40	0.39	<1.00E-06	3.5	24.7
05458000	1.45	62.2	36.3	1.71	90.1	-2.05	0.82	1.56E-02	1.67	0.63	1.06E-02	-3.44	1.07	2.28E-03	2.1	10.3
05462000	1.65	281.7	76.7	3.67	464.1	-7.30	1.02	<1.00E-06	-10.19	0.88	<1.00E-06	1.26	0.96	1.88E-01	16.6	67.1
05463000	1.17	203.1	78.6	2.58	238.5	-5.35	0.84	<1.00E-06	-6.44	0.58	<1.00E-06	-3.31	1.08	3.24E-03	2.8	12.7
05464000	1.60	451.1	155.1	2.91	721.3	2.38	0.29	<1.00E-06	0.75	0.44	9.23E-02	3.08	0.34	<1.00E-06	55.4	195.7
05465000	0.65	896.3	332.1	2.70	584.9	-0.79	0.67	2.43E-01	-2.48	0.49	7.25E-06	0.27	0.79	7.37E-01	95.1	305.8
05465500	1.20	655.4	154.1	4.25	787.1	0.49	0.58	4.00E-01	0.89	0.56	1.13E-01	0.16	0.59	7.86E-01	147.2	521.0
05471050	1.03	192.7	73.8	2.61	198.8	3.98	1.24	2.09E-03	3.42	0.93	4.52E-04	1.16	1.06	2.76E-01	7.5	35.8
05472500	0.77	133.9	43.1	3.11	103.5	2.13	0.42	4.45E-06	2.51	0.39	<1.00E-06	1.41	0.48	4.33E-03	5.4	30.6
05474000	1.31	408.3	109.3	3.74	534.8	3.37	0.44	<1.00E-06	1.74	0.36	1.54E-05	1.91	0.41	3.07E-05	32.4	182.6
05476750	1.71	118.7	56.0	2.12	202.6	0.29	0.57	6.07E-01	0.24	0.46	6.04E-01	0.07	0.56	8.96E-01	12.3	71.1
05479000	1.44	218.6	68.9	3.18	314.8	3.78	0.64	<1.00E-06	1.33	0.35	3.21E-04	3.13	0.66	1.39E-05	6.0	42.9
05481000	1.69	188.0	62.3	3.02	317.9	1.53	0.41	6.64E-04	1.65	0.40	2.06E-04	0.81	0.42	6.08E-02	4.2	31.6
05481300	1.15	683.3	181.5	3.76	787.0	2.38	0.85	1.05E-02	0.22	0.63	7.30E-01	2.73	0.67	5.41E-04	33.8	208.0
05481950	1.18	144.8	57.3	2.53	171.2	4.77	0.86	<1.00E-06	1.58	0.59	1.00E-02	4.88	0.87	<1.00E-06	2.2	13.4
05482300	0.85	83.8	46.7	1.79	71.2	1.80	1.55	2.54E-01	1.05	1.02	3.10E-01	1.98	1.58	2.18E-01	3.7	25.1
05483450	0.68	36.8	31.8	1.16	24.9	-34.92	1.82	<1.00E-06	-29.59	1.86	<1.00E-06	-14.72	2.05	<1.00E-06	2.8	13.0
05484500	1.15	485.9	116.9	4.16	559.5	2.03	0.52	4.22E-04	0.87	0.44	5.45E-02	2.01	0.55	8.90E-04	17.7	123.3
05485640	1.15	62.5	33.8	1.85	72.1	4.92	1.40	1.77E-03	4.74	1.04	1.39E-04	-0.31	1.31	8.17E-01	0.7	4.3
05486000	0.91	148.3	64.8	2.29	135.5	2.56	1.47	9.48E-02	0.25	0.88	7.81E-01	2.13	1.42	1.46E-01	1.4	11.8
05488500	1.33	546.7	145.8	3.75	729.2	13.63	0.25	<1.00E-06	6.13	0.37	<1.00E-06	8.69	0.54	<1.00E-06	94.6	455.9
05489500	1.36	615.5	184.1	3.34	836.0	5.57	1.04	<1.00E-06	5.89	0.95	<1.00E-06	3.23	1.06	3.04E-03	99.7	498.4
05490500	1.81	706.4	169.3	4.17	1281.4	9.56	1.19	<1.00E-06	4.50	1.24	1.31E-03	8.22	1.15	<1.00E-06	108.6	505.5
05495000	1.24	147.9	44.2	3.35	183.4	-4.37	1.40	9.54E-03	-0.86	0.72	2.59E-01	-4.14	1.54	2.24E-02	1.3	14.4
05502300	0.99	111.4	33.8	3.29	110.8	11.22	1.34	<1.00E-06	4.94	1.10	5.79E-05	7.97	1.55	7.52E-06	0.8	13.2
05515500	0.60	43.6	24.4	1.78	26.2	-0.64	1.48	6.70E-01	-0.79	1.09	4.75E-01	-0.35	1.53	8.19E-01	13.9	24.9
05517000	1.32	56.8	32.5	1.75	75.1	-0.02	2.13	9.92E-01	1.16	0.91	2.22E-01	-1.46	1.04	1.83E-01	8.1	25.2
05517530	0.77	131.8	51.9	2.54	101.1	-0.09	0.53	8.68E-01	0.48	0.50	3.49E-01	-0.76	0.51	1.53E-01	35.7	75.0
05522500	0.59	66.4	32.4	2.05	39.1	-4.16	1.22	3.50E-03	-1.74	0.88	6.77E-02	-3.84	1.25	7.78E-03	2.8	13.3
05524500	0.48	144.5	43.2	3.35	69.1	-0.55	2.28	8.10E-01	-1.60	0.38	9.48E-05	0.16	2.52	9.49E-01	5.8	30.3
05525000	0.53	166.0	51.6	3.22	88.4	2.20	1.60	1.75E-01	-0.13	0.36	7.28E-01	1.94	1.50	1.99E-01	8.1	45.9
05525500	0.53	222.8	55.5	4.02	118.9	-2.30	1.78	2.02E-01	-1.26	0.94	1.89E-01	-1.90	1.70	2.68E-01	3.7	28.3
05526000	1.10	475.3	134.2	3.54	524.6	0.11	0.85	8.98E-01	0.79	0.43	7.42E-02	-0.58	0.96	5.49E-01	23.0	133.8
05527800	0.17	52.8	30.0	1.76	9.2	-2.76	3.54	4.44E-01	2.98	0.79	1.08E-03	-7.50	3.50	4.41E-02	1.2	7.7
05529000	0.46	123.5	46.2	2.67	56.7	-4.05	1.08	3.23E-03	-2.53	1.11	4.65E-02	-3.65	1.13	9.06E-03	5.0	22.0
05536275	0.66	56.3	30.6	1.84	37.0	14.57	1.78	<1.00E-06	4.53	1.40	5.10E-03	14.36	2.52	3.26E-05	1.3	6.5
05536290	0.51	143.1	45.6	3.14	72.7	-2.69	0.73	1.48E-03	-0.39	0.49	4.38E-01	-2.59	0.77	3.41E-03	2.4	11.9
05540500	1.07	104.9	56.0	1.87	112.0	-0.19	1.28	8.87E-01	-0.16	0.14	3.00E-01	1.07	0.94	2.86E-01	5.9	19.7
05543830	1.29	23.1	20.2	1.15	29.8	-4.60	1.57	1.09E-02	-0.55	0.46	2.53E-01	-2.92	1.39	5.53E-02	2.1	7.1
05548280	0.51	25.9	25.3	1.03	13.1	-2.98	1.24	2.58E-02	-2.70	1.17	3.20E-02	-0.86	0.82	3.09E-01	3.1	7.7
05555300	0.97	293.2	61.4	4.77	284.7	-3.75	2.10	9.40E-02	2.99	1.48	6.24E-02	-2.96	2.97	3.36E-01	9.1	63.6
05569500	0.92	167.1	45.2	3.69	153.1	-2.26	2.52	3.78E-01	0.09	1.02	9.28E-01	-2.70	2.59	3.09E-01	10.1	47.9
05572000	0.47	139.0	85.3	1.63	64.9	-6.75	0.89	<1.00E-06	-5.63	0.76	<1.00E-06	-6.35	0.95	<1.00E-06	4.9	31.1
05578500	0.47	42.5	23.3	1.83	19.9	-9.57	1.65	<1.00E-06	0.17	0.89	8.47E-01	-8.70	1.68	4.04E-06	2.8	17.9
05584500	0.72	176.5	47.2	3.74	127.2	2.59	1.84	1.74E-01	1.76	0.94	7.66E-02	2.07	1.97	3.08E-01	3.6	26.2
05592500	0.87	217.6	51.8	4.20	189.0	-0.76	0.41	7.00E-02	1.09	0.29	2.93E-04	-0.66	0.47	1.65E-01	22.5	112.3
06025500	2.07	110.1	61.2	1.80	228.1	-1.60	0.50	2.60E-03	-2.62	0.46	1.26E-06	0.67	0.57	2.48E-01	12.9	86.6
06043500	2.86	71.0	44.4	1.60	202.6	0.87	0.53	1.11E-01	-0.12	0.45	7.95E-01	1.07	0.45	2.36E-02	12.1	60.0
06054500	1.97	346.3	121.0	2.86	682.2	0.01	0.30	9.83E-01	-0.39	0.22	8.52E-02	0.20	0.31	5.31E-01	110.1	242.5
06099500	1.64	151.1	67.6	2.23	247.8	-8.04	1.21	<1.00E-06	-0.56	1.02	5.87E-01	-8.14	1.46	4.95E-06	10.4	62.3
06115200	1.49	801.7	182.3	4.40	1191.5	-9.10	1.41	<1.00E-06	-3.64	0.91	3.67E-04	-8.93	1.48	1.31E-06	212.4	409.2
06334500	0.88	104.0	67.4	1.54	91.6	-3.47	1.38	2.11E-02	-1.93	1.06	8.62E-02	-3.08	1.27	2.56E-02	0.3	4.2

STAID	$\overline{U_{FS}}$ (m/s)	$\overline{A_{FS}}$ (m^2)	$\overline{w_{FS}}$ (m)	$\overline{h_{FS}}$ (m)	$\overline{Q_{FS}}$ (m^3/s)	$\hat{Q}$ (%/dec)	$\hat{Q}$ SE (%/dec)	$\hat{Q}$ p	$\hat{A}$ (%/dec)	$\hat{A}$ SE (%/dec)	$\hat{A}$ p	$\hat{U}$ (%/dec)	$\hat{U}$ SE (%/dec)	$\hat{U}$ p	Q_{50} (m^3/s)	Q_{90} (m^3/s)
06340500	1.29	155.1	45.1	3.44	200.1	4.14	2.05	6.59E-02	2.14	1.27	1.20E-01	4.39	2.09	6.02E-02	0.8	5.8
06349500	0.56	59.0	13.7	4.30	33.2	5.59	3.94	1.79E-01	-1.02	1.78	5.75E-01	7.58	3.16	3.35E-02	0.1	1.3
06354000	1.15	123.3	74.1	1.66	141.6	-2.29	1.67	1.80E-01	0.20	1.33	8.82E-01	-3.65	1.86	6.02E-02	0.8	9.4
06354882	0.73	34.8	11.8	2.95	25.4	9.01	1.73	1.65E-04	8.04	2.03	1.88E-03	4.35	2.87	1.55E-01	0.03	0.7
06360500	1.73	256.9	49.9	5.14	446.2	1.52	1.87	4.31E-01	0.58	0.94	5.47E-01	0.82	1.36	5.57E-01	0.2	7.9
06436760	1.27	122.1	29.7	4.11	154.9	2.11	2.66	4.53E-01	-4.55	1.40	1.76E-02	4.82	1.35	1.18E-02	0.2	1.8
06437000	1.76	258.3	89.9	2.87	454.3	0.94	0.90	3.15E-01	0.26	0.83	7.55E-01	0.62	0.88	4.96E-01	3.1	11.8
06441500	1.66	182.6	62.7	2.91	303.3	5.95	2.34	1.96E-02	4.71	1.77	1.62E-02	-0.39	2.20	8.62E-01	0.02	3.8
06471000	0.28	82.3	36.7	2.24	22.8	5.38	2.13	1.29E-02	-0.83	0.64	1.99E-01	5.33	2.18	1.59E-02	1.1	11.4
06471500	0.63	131.6	35.5	3.71	82.8	3.79	1.81	5.21E-02	-0.42	1.03	6.89E-01	3.92	2.00	6.73E-02	0.2	1.7
06473000	0.37	116.8	64.6	1.81	43.2	10.67	0.95	<1.00E-06	2.53	0.42	<1.00E-06	7.73	1.01	<1.00E-06	1.6	19.1
06477000	0.55	125.5	52.2	2.41	68.6	3.35	0.83	2.27E-04	5.85	0.81	<1.00E-06	1.02	1.25	4.17E-01	3.2	21.8
06477500	0.62	32.0	23.7	1.35	19.9	-3.53	1.92	7.48E-02	-0.92	0.72	2.09E-01	-3.11	1.68	7.35E-02	0.01	0.4
06479010	0.99	126.2	40.6	3.11	125.5	19.44	0.99	<1.00E-06	14.67	0.81	<1.00E-06	17.17	2.00	<1.00E-06	3.0	16.3
06479525	0.29	68.2	63.8	1.07	19.9	-2.16	1.65	2.00E-01	-0.60	1.38	6.65E-01	-1.83	1.57	2.53E-01	0.7	4.7
06480000	0.56	103.3	43.5	2.37	57.8	10.05	0.74	<1.00E-06	9.20	1.17	<1.00E-06	11.10	0.71	<1.00E-06	2.0	14.3
06481000	0.65	183.8	70.2	2.62	119.0	-2.29	0.81	6.51E-03	-0.51	0.53	3.42E-01	-2.16	0.83	1.09E-02	3.2	19.4
06607500	1.81	382.0	73.6	5.19	692.8	1.64	0.36	4.29E-05	2.20	0.34	<1.00E-06	0.94	0.44	3.92E-02	18.3	75.3
06625000	2.01	45.8	31.7	1.44	92.2	-0.59	0.50	2.40E-01	-0.24	0.25	3.34E-01	-0.38	0.44	3.97E-01	2.2	23.6
06795500	0.70	100.0	26.4	3.79	70.5	3.21	2.40	1.91E-01	1.57	0.77	4.97E-02	2.49	2.50	3.28E-01	0.5	1.7
06796000	1.81	676.4	429.4	1.58	1221.6	9.09	2.53	8.13E-04	1.84	1.90	3.39E-01	4.54	1.92	2.22E-02	98.8	195.7
06799350	2.07	221.9	106.0	2.09	458.6	-23.22	4.66	1.18E-05	-7.85	3.20	1.87E-02	-2.69	2.49	2.86E-01	16.4	45.9
06800000	1.39	82.2	25.0	3.28	114.3	10.69	2.84	1.90E-03	9.95	2.65	2.13E-03	6.23	2.95	5.33E-02	0.6	2.2
06805500	1.61	1166.1	390.5	2.99	1877.5	7.59	1.14	<1.00E-06	8.05	1.03	<1.00E-06	1.18	0.92	2.01E-01	133.8	298.7
06807000	1.63	1444.1	221.4	6.52	2360.2	-3.98	0.14	<1.00E-06	-1.61	0.13	<1.00E-06	-4.02	0.13	<1.00E-06	1049.1	1346.5
06807410	1.34	207.9	58.1	3.58	278.2	-1.02	2.58	6.97E-01	4.77	1.46	4.03E-03	-2.87	1.56	8.22E-02	4.6	16.2
06811500	1.84	306.3	61.5	4.98	564.4	-2.00	1.60	2.31E-01	-0.76	0.79	3.54E-01	-2.49	1.64	1.52E-01	2.9	10.1
06818000	1.50	1655.0	251.8	6.57	2483.3	0.70	0.82	3.97E-01	0.72	0.50	1.53E-01	0.66	0.78	4.02E-01	1138.3	1602.7
06847000	0.57	51.4	25.9	1.99	29.3	-11.38	1.73	2.68E-06	-8.83	1.06	<1.00E-06	-11.75	1.70	1.90E-06	0.03	0.1
06853020	0.87	111.1	72.9	1.52	96.5	-7.81	2.49	4.95E-03	-5.83	1.70	2.69E-03	-3.29	2.53	2.07E-01	2.6	4.4
06876700	0.62	64.3	23.1	2.79	39.5	7.74	3.12	2.38E-02	0.19	3.09	9.51E-01	10.30	2.97	3.15E-03	0.3	1.8
06876900	0.88	211.1	49.7	4.25	185.7	0.13	1.48	9.32E-01	0.86	0.83	3.20E-01	-0.94	1.27	4.67E-01	4.1	18.5
06880000	0.61	59.4	25.0	2.38	36.5	3.40	0.95	7.06E-04	0.37	0.83	6.55E-01	3.19	0.75	7.38E-05	0.4	1.7
06881000	0.89	115.9	41.1	2.82	103.0	-2.24	0.99	3.42E-02	-2.42	1.06	3.25E-02	-1.60	1.05	1.42E-01	4.1	16.3
06882000	1.29	347.5	70.8	4.91	449.7	6.87	1.48	7.10E-05	2.58	0.51	2.70E-05	3.50	2.11	1.09E-01	8.2	42.3
06890100	1.49	291.6	55.0	5.30	434.1	6.89	1.40	1.49E-04	4.31	1.32	5.30E-03	5.69	1.19	2.47E-04	1.3	8.9
06894000	1.16	154.6	54.3	2.85	179.7	-2.20	2.62	4.10E-01	0.83	1.10	4.61E-01	-2.59	2.66	3.42E-01	1.5	7.8
06897500	1.32	531.2	98.8	5.38	703.6	3.37	2.20	1.43E-01	4.95	2.12	3.21E-02	1.15	2.58	6.62E-01	7.2	69.1
06898000	2.04	177.4	51.5	3.45	362.1	5.18	1.39	7.41E-04	2.62	0.78	2.02E-03	1.68	1.50	2.69E-01	2.3	21.5
06902000	1.22	466.0	87.2	5.34	567.3	2.08	1.04	5.22E-02	2.69	0.59	5.18E-05	1.60	1.31	2.29E-01	28.7	272.0
06905500	1.26	251.7	58.5	4.30	316.5	10.21	0.69	<1.00E-06	9.19	0.59	<1.00E-06	7.88	0.96	<1.00E-06	12.6	76.2
06906800	1.26	229.1	55.6	4.12	288.2	-0.99	1.25	4.51E-01	-0.04	0.19	8.28E-01	-0.40	0.58	5.15E-01	1.7	20.5
06913500	0.70	536.8	90.9	5.91	374.4	2.36	1.02	3.59E-02	-0.70	0.69	3.28E-01	1.12	1.32	4.15E-01	3.2	50.8
06934500	1.51	3546.8	430.3	8.24	5365.2	2.58	0.38	<1.00E-06	2.86	0.31	<1.00E-06	2.39	0.40	<1.00E-06	1856.9	4233.4
07010000	1.88	7474.7	598.7	12.49	14032.1	0.39	0.20	5.06E-02	1.45	0.12	<1.00E-06	1.09	0.21	<1.00E-06	4700.6	9981.7
07014500	0.93	229.3	58.2	3.94	213.9	3.04	0.83	1.16E-03	1.90	0.46	3.68E-04	2.77	0.55	3.49E-05	17.5	61.9
07016500	1.28	242.8	54.1	4.49	311.8	-0.38	0.39	3.41E-01	-0.90	0.27	1.98E-03	0.17	0.43	6.95E-01	5.0	32.8
07018100	0.93	290.5	92.7	3.13	269.8	-1.11	1.34	4.25E-01	2.11	1.66	2.34E-01	-1.84	2.22	4.28E-01	8.5	35.7
07019000	1.83	472.9	95.5	4.95	865.3	3.55	1.06	3.00E-03	3.25	0.83	8.48E-04	1.84	1.14	1.23E-01	42.1	184.9
07022000	1.61	8015.0	671.8	11.93	12927.3	3.19	0.68	6.19E-06	3.64	0.34	<1.00E-06	3.17	0.84	2.38E-04	5097.0	10831.2
07029500	0.68	964.7	444.3	2.17	658.1	-2.82	1.60	8.18E-02	-1.84	1.36	1.83E-01	-2.88	1.49	5.70E-02	29.7	164.5
07060500	1.82	993.8	192.9	5.15	1807.6	-0.32	0.76	6.79E-01	0.06	0.37	8.65E-01	-0.18	0.72	8.02E-01	220.7	563.5
07072500	1.16	370.6	81.4	4.55	430.1	0.78	0.80	3.36E-01	0.95	0.72	1.96E-01	0.21	0.70	7.64E-01	165.2	508.3
07147800	1.47	339.0	75.4	4.49	499.9	5.95	2.19	1.59E-02	5.55	2.01	1.52E-02	3.83	2.04	8.14E-02	5.2	53.8
07151000	0.71	495.2	162.1	3.06	353.2	3.14	1.41	3.68E-02	2.69	0.89	6.62E-03	2.64	1.52	9.92E-02	7.7	45.9
07153000	1.38	174.3	48.9	3.57	240.8	11.84	1.19	<1.00E-06	8.42	1.90	8.13E-04	8.27	1.33	4.32E-05	0.4	8.1
07171000	1.47	659.3	99.4	6.63	969.9	0.88	1.03	3.98E-01	1.04	0.65	1.24E-01	0.14	1.05	8.95E-01	13.0	201.8
07185000	1.63	369.2	90.7	4.07	601.4	1.92	0.86	3.62E-02	0.54	0.58	3.59E-01	1.79	0.87	5.18E-02	26.5	286.0
07186000	1.93	250.4	55.0	4.55	483.1	-0.43	1.18	7.21E-01	0.63	0.78	4.41E-01	-1.56	0.99	1.47E-01	8.6	47.6
07188000	1.75	513.2	97.8	5.25	899.3	4.31	0.98	4.99E-04	2.06	0.89	3.59E-02	3.94	1.11	3.21E-03	24.6	111.6
07195500	0.82	287.1	78.9	3.64	235.4	0.94	0.70	2.08E-01	0.67	0.63	3.14E-01	1.23	0.74	1.31E-01	9.4	33.6
07227500	2.99	139.5	71.5	1.95	417.6	10.88	2.78	1.74E-04	8.62	1.78	5.11E-06	-1.40	2.31	5.46E-01	0.7	7.1
07230500	0.87	23.6	27.8	0.85	20.5	52.48	5.04	<1.00E-06	15.17	4.79	3.06E-03	7.44	3.77	5.61E-02	0.6	5.5
07241550	1.03	205.3	70.4	2.91	211.0	4.08	2.80	1.68E-01	5.94	1.85	7.57E-03	8.60	4.07	5.62E-02	6.2	26.8
07268000	0.64	704.7	413.2	1.71	450.3	-16.41	5.82	1.66E-02	-0.77	3.36	8.23E-01	-13.68	4.70	1.56E-02	5.7	44.5
07312200	0.48	113.8	48.4	2.35	55.1	0.62	1.48	6.78E-01	-3.54	1.11	2.60E-03	0.40	1.81	8.27E-01	0.1	1.8
07312500	0.56	264.6	94.6	2.80	148.3	0.71	1.14	5.37E-01	0.43	0.59	4.76E-01	0.66	1.16	5.73E-01	2.2	8.9
07336200	1.44	474.3	84.8	5.60	681.0	-0.66	1.38	6.40E-01	-0.92	0.97	3.63E-01	-0.01	0.97	9.95E-01	9.4	113.3
07340000	1.04	725.1	115.3	6.29	753.2	1.03	0.50	4.88E-02	-0.05	0.28	8.63E-01	0.87	0.53	1.12E-01	43.6	286.0
07340500	0.81	401.9	112.4	3.58	326.3	2.49	0.89	6.93E-03	4.40	0.44	<1.00E-06	1.80	1.41	2.06E-01	3.9	36.4
07346045	0.18	183.8	137.5	1.34	33.0	2.52	1.15	4.24E-02	-0.07	1.82	9.70E-01	2.47	1.61	1.44E-01	3.9	22.3
07348700	0.21	112.0	35.3	3.18	24.0	0.94	1.00	3.55E-01	0.68	0.29	2.59E-02	0.98	0.95	3.14E-01	2.7	39.5
07375000	0.45	129.9	59.7	2.18	58.7	-0.19	1.80	9.19E-01	-0.31	1.96	8.79E-01	-1.11	0.88	2.37E-01	1.9	7.2
07375500	0.42	387.2	204.5	1.89	163.2	-5.72	1.17	8.88E-05	-5.96	1.39	3.94E-04	-4.37	0.99	3.00E-04	17.9	54.1
08015500	0.37	903.4	445.8	2.03	338.3	1.09	1.88	5.72E-01	1.11	1.93	5.76E-01	-0.47	1.43	7.50E-01	25.5	150.1
08019000	0.25	366.1	186.5	1.96	90.9	0.56	1.76	7.54E-01	1.98	1.81	2.95E-01	-0.59	2.07	7.80E-01	1.1	23.6
08028000	0.63	135.9	39.2	3.47	85.5	5.95	0.77	<1.00E-06	6.34	0.76	<1.00E-06	5.31	1.22	2.56E-04	3.8	27.5
08032000	0.29	114.1	66.1	1.73	33.2	4.77	0.62	<1.00E-06	0.42	0.54	4.38E-01	5.02	0.64	<1.00E-06	7.3	38.7
08038000	0.34	97.8	31.3	3.13	33.5	2.51	0.73	1.18E-03	2.06	0.46	4.80E-05	2.36	0.76	3.29E-03	4.0	23.0
08039100	0.20	197.7	161.8	1.22	39.5	2.40	1.52	1.29E-01	-0.12	1.23	9.22E-01	1.56	1.65	3.57E-01	0.4	4.3
08041000	0.51	1868.2	760.2	2.46	953.9	1.57	1.12	1.75E-01	0.48	0.55	3.90E-01	1.37	1.06	2.09E-01	94.9	386.5
08041500	0.41	485.2	193.0	2.51	200.6	1.45	0.84	9.45E-02	-0.69	0.56	2.25E-01	2.38	0.80	6.25E-03	8.7	53.7
08041700	0.31	147.3	74.7	1.97	45.5	-2.34	1.07	3.45E-02	-1.29	0.54	2.16E-02	-1.66	1.15	1.58E-01	2.1	33.3
08057000	0.89	256.5	59.9	4.28	229.6	9.46	2.14	8.75E-05	2.85	0.57	1.83E-05	4.91	2.85	9.33E-02	13.9	145.4
08065000	0.86	598.2	128.8	4.64	513.2	8.98	0.41	<1.00E-06	5.20	0.55	<1.00E-06	8.69	0.48	<1.00E-06	48.0	390.8
08065350	0.88	1425.4	142.1	10.03	1249.0	3.10	1.99	1.34E-01	6.76	1.25	2.67E-05	-0.30	2.37	9.01E-01	59.7	508.3
08066250	1.18	1144.8	128.8	8.89	1351.6	2.02	1.09	7.59E-02	1.63	0.48	2.45E-03	0.50	0.81	5.45E-01	78.6	598.9
08066300	0.41	117.2	102.8	1.14	48.3	-2.18	2.18	3.38E-01	-4.19	1.46	1.69E-02	3.02	2.19	1.98E-01	1.3	6.6

STAID	$\overline{U_{FS}}$ (m/s)	$\overline{A_{FS}}$ (m^2)	$\overline{w_{FS}}$ (m)	$\overline{h_{FS}}$ (m)	$\overline{Q_{FS}}$ (m^3/s)	$\hat{Q}$ (%/dec)	$\hat{Q}$ SE (%/dec)	$\hat{Q}$ p	$\hat{A}$ (%/dec)	$\hat{A}$ SE (%/dec)	$\hat{A}$ p	$\hat{U}$ (%/dec)	$\hat{U}$ SE (%/dec)	$\hat{U}$ p	Q_{50} (m^3/s)	Q_{90} (m^3/s)
08068090	1.07	269.5	89.8	3.00	289.1	-1.16	1.94	5.59E-01	-0.82	1.66	6.33E-01	-0.28	0.66	6.79E-01	3.5	46.6
08117500	0.54	155.0	67.8	2.29	84.2	3.80	0.40	<1.00E-06	3.14	0.36	<1.00E-06	3.62	0.45	<1.00E-06	3.5	29.7
08123850	0.87	172.3	42.4	4.06	150.4	-1.68	3.15	6.03E-01	0.62	1.57	6.97E-01	-0.80	3.36	8.16E-01	0.2	1.5
08151500	1.69	207.0	144.4	1.43	349.4	9.61	1.17	<1.00E-06	8.43	0.90	<1.00E-06	4.77	1.54	4.59E-03	4.5	10.9
08162000	1.27	1018.9	167.4	6.09	1297.2	2.49	1.87	2.09E-01	-0.05	0.63	9.33E-01	1.10	1.92	5.80E-01	32.0	102.6
08164000	0.50	304.6	247.8	1.23	151.8	1.95	0.92	4.03E-02	0.98	0.58	1.01E-01	1.77	0.97	7.61E-02	1.8	10.7
08164300	0.46	388.0	228.9	1.69	180.1	-1.90	1.26	1.52E-01	-1.08	0.95	2.79E-01	-0.45	0.97	6.55E-01	0.7	2.8
08164503	0.52	393.8	140.3	2.81	206.4	-3.76	0.99	7.71E-04	-1.60	0.59	1.13E-02	-3.77	1.03	1.12E-03	0.6	7.1
08164600	0.62	176.4	54.9	3.22	109.5	-8.81	1.53	8.95E-06	-2.10	1.15	8.34E-02	-6.26	1.72	1.55E-03	0.1	1.4
08175000	0.52	207.0	128.8	1.61	106.9	0.03	0.73	9.66E-01	0.65	0.44	1.69E-01	-0.46	0.41	2.85E-01	0.3	3.0
08178800	0.78	119.0	64.1	1.86	92.3	3.04	0.94	3.24E-03	0.17	0.64	7.96E-01	2.37	0.78	5.29E-03	0.4	1.5
08183500	1.31	172.8	45.1	3.83	225.8	7.25	0.93	<1.00E-06	8.68	0.84	<1.00E-06	4.14	2.06	5.66E-02	8.7	19.3
08188500	0.76	244.2	62.7	3.90	186.4	5.29	0.58	<1.00E-06	1.94	0.43	3.80E-05	5.27	0.59	<1.00E-06	10.3	29.6
08189200	0.43	60.3	38.6	1.56	26.0	3.34	2.02	1.12E-01	5.81	0.92	2.05E-06	-1.59	1.51	3.02E-01	0.0003	1.4
08194000	0.32	442.8	280.7	1.58	141.5	-5.72	1.64	2.09E-03	-5.25	1.20	2.71E-04	-2.66	1.54	9.92E-02	0.001	6.1
08194500	0.55	69.4	45.4	1.53	38.2	4.70	0.70	<1.00E-06	0.62	0.64	3.35E-01	5.18	0.72	<1.00E-06	0.1	14.8
08211520	0.66	100.8	33.9	2.97	66.2	-3.97	2.41	1.25E-01	-1.46	1.08	2.04E-01	-1.12	2.20	6.20E-01	0.1	0.5
08279500	2.30	81.1	30.3	2.68	186.8	-0.29	1.13	8.01E-01	-1.38	0.54	2.28E-02	-1.47	1.16	2.23E-01	14.6	34.3
09112500	2.30	35.3	26.5	1.33	81.1	0.84	1.24	5.04E-01	-2.30	1.04	3.44E-02	1.81	1.41	2.06E-01	2.9	27.8
09128000	2.56	91.6	42.5	2.15	234.6	0.11	1.10	9.20E-01	-1.83	0.75	2.34E-02	1.57	1.24	2.20E-01	17.1	52.7
09211200	1.73	169.7	85.3	1.99	292.8	-1.83	0.50	8.54E-04	-1.74	0.35	2.39E-05	-0.87	0.51	9.81E-02	28.9	92.3
10039500	0.71	121.5	48.5	2.51	85.7	-2.21	0.52	6.71E-05	-2.50	0.32	<1.00E-06	-0.95	0.64	1.43E-01	5.7	26.4
10312150	1.33	41.9	28.6	1.47	55.7	-2.31	0.68	7.49E-04	3.45	0.39	<1.00E-06	-5.26	0.72	<1.00E-06	12.0	27.6
10321000	1.39	63.8	33.2	1.92	88.4	0.13	0.55	8.10E-01	-0.02	0.35	9.59E-01	-0.26	0.46	5.77E-01	2.6	26.5
11348500	1.05	101.8	71.5	1.42	106.6	-2.74	0.93	7.97E-03	-2.59	0.95	1.40E-02	-1.46	0.52	1.16E-02	2.8	12.3
12048000	2.94	43.5	28.6	1.52	128.2	2.21	1.00	4.34E-02	0.67	0.55	2.39E-01	-0.03	0.46	9.41E-01	8.6	20.2
12194000	2.53	702.9	141.0	4.98	1775.2	0.76	0.24	4.27E-03	0.52	0.22	2.85E-02	0.74	0.25	6.05E-03	380.9	673.9
12304500	2.59	77.0	46.7	1.65	199.2	-0.49	0.33	1.43E-01	0.57	0.27	3.81E-02	-0.84	0.35	1.90E-02	7.9	69.4
12340000	2.62	169.0	68.1	2.48	442.4	-1.37	0.27	1.16E-05	-0.80	0.13	<1.00E-06	-0.73	0.38	6.46E-02	19.9	120.1
12340500	2.12	245.7	79.8	3.08	520.7	0.46	0.29	1.22E-01	0.00	0.16	9.78E-01	0.47	0.30	1.33E-01	47.0	206.4
12344000	2.48	92.8	53.1	1.75	230.1	4.78	1.42	2.30E-03	3.59	0.89	4.09E-04	-0.15	1.35	9.11E-01	10.2	72.6
12353000	2.57	485.5	127.6	3.80	1250.1	-0.35	0.36	3.32E-01	-0.51	0.12	1.68E-04	-0.74	0.40	6.77E-02	78.3	407.8
12354500	2.72	626.6	128.1	4.89	1704.6	-0.34	0.25	1.90E-01	-0.22	0.21	3.05E-01	-0.34	0.27	2.12E-01	103.1	532.4
12358500	2.52	281.0	87.7	3.20	708.1	0.07	0.26	7.98E-01	0.03	0.19	8.93E-01	0.27	0.18	1.41E-01	30.6	251.7
12363000	2.18	584.5	148.1	3.95	1273.9	-1.78	0.19	<1.00E-06	-1.44	0.20	<1.00E-06	-1.38	0.24	<1.00E-06	183.6	649.9
12370000	1.54	128.8	86.3	1.49	199.0	-0.11	0.20	5.93E-01	-0.57	0.19	3.39E-03	0.28	0.23	2.35E-01	18.6	83.4
12389000	2.66	1085.0	162.2	6.69	2887.6	-1.20	0.17	<1.00E-06	-0.91	0.15	<1.00E-06	-1.18	0.20	<1.00E-06	404.9	1226.1
12401500	2.16	184.4	69.9	2.64	398.0	2.21	0.52	1.27E-04	1.79	0.31	1.18E-06	0.60	0.54	2.73E-01	10.1	153.2
12422500	2.70	342.5	85.4	4.01	924.7	-1.37	0.32	1.54E-04	-0.58	0.25	3.02E-02	-1.19	0.27	1.46E-04	112.1	497.0
12424000	2.68	102.3	40.5	2.53	274.7	2.65	1.45	8.25E-02	2.96	0.80	1.54E-03	-1.70	0.54	5.46E-03	1.3	16.6
12442500	2.44	287.1	80.6	3.56	701.0	-0.20	0.40	6.19E-01	-0.37	0.21	8.40E-02	0.14	0.38	7.21E-01	22.3	191.3
12449950	3.14	165.4	62.3	2.65	519.5	-1.24	0.45	9.99E-03	-1.37	0.45	5.57E-03	-0.28	0.30	3.52E-01	15.1	119.2
12459000	2.30	305.5	78.4	3.90	702.7	-0.34	0.62	5.89E-01	-0.55	0.20	1.30E-02	0.83	0.78	3.02E-01	47.6	215.2
12472800	2.45	4548.8	390.6	11.65	11164.2	-0.16	0.18	3.79E-01	0.12	0.07	9.47E-02	-0.39	0.19	5.57E-02	2776.5	5465.1
12484500	2.37	145.2	64.3	2.26	344.0	-1.03	0.17	<1.00E-06	-0.66	0.12	<1.00E-06	-0.84	0.17	5.05E-06	62.9	121.6
12510500	1.88	284.5	99.0	2.88	534.4	-0.29	0.31	3.68E-01	-0.06	0.14	6.68E-01	-0.28	0.29	3.52E-01	75.3	178.8
13037500	2.34	295.4	120.5	2.45	691.5	3.36	0.41	<1.00E-06	1.18	0.25	1.02E-05	2.03	0.38	<1.00E-06	108.7	396.4
13060000	1.98	398.5	151.2	2.64	788.7	0.37	0.25	1.56E-01	0.71	0.24	6.15E-03	-0.07	0.26	8.01E-01	112.1	294.5
13168500	2.01	50.3	29.7	1.69	101.5	-2.92	0.61	4.75E-05	-3.27	0.46	<1.00E-06	-0.03	0.91	9.71E-01	3.9	31.0
13247500	2.14	229.6	80.6	2.85	492.4	1.06	0.39	1.26E-02	0.54	0.41	2.04E-01	0.95	0.35	1.42E-02	69.2	201.2
13249500	1.91	240.1	111.5	2.15	459.6	-1.03	0.48	3.91E-02	-1.05	0.49	4.02E-02	-0.78	0.49	1.24E-01	53.7	189.4
13251000	1.90	268.3	93.0	2.88	510.9	-2.08	0.73	9.62E-03	-0.93	0.96	3.45E-01	-2.96	0.66	2.42E-04	54.5	187.0
13266000	2.30	113.7	56.7	2.01	261.2	-8.66	1.66	1.06E-05	-3.07	0.90	1.74E-03	-5.57	1.61	1.62E-03	10.5	74.2
14046500	2.43	200.6	70.1	2.86	487.8	1.81	0.63	7.61E-03	2.28	0.64	1.33E-03	0.79	0.63	2.24E-01	23.8	150.1
14190500	0.69	277.8	70.8	3.92	192.6	1.12	0.75	1.48E-01	0.09	0.37	8.19E-01	1.12	0.78	1.67E-01	9.9	57.9
14301000	2.05	271.3	72.2	3.76	555.8	-0.43	0.57	4.47E-01	0.20	0.47	6.70E-01	-0.90	0.33	8.48E-03	32.1	200.2
15024800	2.19	3487.7	418.2	8.34	7655.6	0.79	0.95	4.09E-01	-1.91	0.85	2.88E-02	2.30	0.89	1.18E-02	863.7	3794.5
15258000	1.25	257.1	108.4	2.37	321.5	0.93	0.36	1.38E-02	1.46	0.34	8.65E-05	0.87	0.43	5.15E-02	47.3	191.8
15292000	3.31	477.3	141.3	3.38	1581.7	4.09	0.59	<1.00E-06	0.15	0.61	8.03E-01	4.83	0.54	<1.00E-06	96.4	720.7
0208111310	0.46	62.9	43.2	1.46	28.8	-0.17	2.99	9.54E-01	2.48	2.58	3.45E-01	-3.56	2.86	2.23E-01	0.7	6.2

8.3. Chapter 4 Data

Sorted by USGS station ID (STAID)

Pages 210-221:

DA (km^2): USGS values of drainage area, measured at the stream gage

Elev. (m): USGS values of elevation, measured at the datum of the stream gage

Precip. (mm/y): mean annual precipitation 30 arc-second (1km) average for the period 1950-2000, obtained from CGIAR-CSI geo-spatial dataset (Trabucco and Zomer, 2009).

Flow Ref. Condition: Streamflow Reference Classification from the GAGES II dataset (Falcone, 2011), which classifies sites as being in reference versus non-reference conditions.

RBI: mean R-B flashiness index

RBI (yrs): number of complete flow years used to compute the mean R-B flashiness index

Channel capacity ($\overline{Q_{50}}$, m^3/s) $\overline{A_{50}}$ **(m^2)** $\overline{U_{50}}$ **(m/s)** $\overline{w_{50}}$ **(m)** $\overline{h_{50}}$ **(m)**	Time-averaged values of cross-sectional discharge (Q), cross-sectional flow area (A), cross-sectional average flow velocity (U), channel width (w), and cross-sectional average channel depth (h) at G_{50}, obtained from the rating curves relating Q, A, U, w, or h to G (Gage height).

Pages 221-234:

$\hat{w}$ **(%/dec):** trend in the estimated values of width at G_{50} ($\hat{w}$)

$\hat{w}$ **SE (%/dec):** standard error of the trend in $\hat{w}$

$\hat{w}$ **p:** significance of the trend in $\hat{w}$

$\hat{h}$ **(%/dec):** trend in the estimated values of depth at G_{50} ($\hat{h}$)

$\hat{h}$ **SE (%/dec):** standard error of the trend in $\hat{h}$

$\hat{h}$ **p:** significance of the trend in $\hat{h}$

$\hat{U}$ **(%/dec):** trend in the estimated values of velocity at G_{50} ($\hat{U}$)

$\hat{U}$ **SE(%/dec):** standard error of the trend in $\hat{U}$

$\hat{U}$ **p:** significance of the trend in $\hat{U}$

$\hat{Q}$ **(%/dec):** trend in the estimated values of discharge at G_{50} ($\hat{Q}$)

$\hat{Q}$ **SE (%/dec):** standard error of the trend in Q

$\hat{Q}$ **p:** significance of the trend in Q

N msts: number of channel measurements (Q, A, W, h, and U)

N years: length of trends in $\hat{w}$, $\hat{h}$, $\hat{U}$, and $\hat{Q}$

STAID	DA (km^2)	Elev. (m)	Precip. (mm/y)	Flow Ref. Condition	RBI	RBI (yrs)	Channel capacity $\overline{Q_{50}}$ (m^3/s)	$\overline{A_{50}}$ (m^2)	$\overline{V_{50}}$ (m/s)	$\overline{W_{50}}$ (m)	$\overline{D_{50}}$ (m)
01034000	3010	76	1049	Non-ref	0.19	56	73.54	151.1	0.49	108.1	1.4
01047000	914	92	1050	Ref	0.30	64	18.73	48.7	0.38	63.9	0.8
01048000	1336	60	1057	Non-ref	0.29	55	27.67	61.0	0.45	64.0	1.0
01059000	8451	33	1138	Non-ref	0.18	64	172.91	385.5	0.45	120.1	3.2
01089100	212	78	1007	Non-ref	0.23	25	2.28	7.0	0.33	18.0	0.4
01094400	166	120	1133	Non-ref	0.28	41	2.24	6.3	0.36	16.2	0.4
01097000	300	43	1117	Non-ref	0.15	64	3.79	7.0	0.54	14.5	0.5
01099500	1036	21	1095	Non-ref	0.06	64	15.59	26.6	0.59	38.1	0.7
01100000	12005	2	1092	Non-ref	0.13	64	239.84	363.7	0.66	101.7	3.6
01101000	55	7	1144	Non-ref	0.10	64	0.66	1.5	0.43	5.0	0.3
01102500	63	5	1139	Non-ref	0.31	63	0.68	5.1	0.13	11.4	0.5
01105585	11	2	1153	Non-ref	0.49	28	0.09	0.5	0.20	2.6	0.2
01105933	68	8	1180	Non-ref	0.21	18	0.60	3.0	0.20	8.4	0.4
01109000	112	17	1178	Non-ref	0.15	64	1.76	3.9	0.46	8.8	0.4
01114500	99	29	1184	Non-ref	0.16	64	1.46	3.3	0.44	8.7	0.4
01116000	163	66	1198	Non-ref	0.16	64	2.92	7.8	0.37	20.2	0.4
01117000	59	2	1150	Non-ref	0.23	64	1.00	3.4	0.29	18.0	0.2
01117468	23	33	1190	Ref	0.16	39	0.50	2.0	0.25	4.7	0.4
01118300	10	47	1212	Ref	0.32	55	0.17	1.0	0.17	5.2	0.2
01123360	162	187	1191	Non-ref	0.15	28	1.98	4.9	0.40	16.0	0.3
01127000	1847	19	1218	Non-ref	0.16	64	9.64	23.5	0.41	38.3	0.6
01127500	231	29	1233	Non-ref	0.35	64	2.77	6.4	0.43	15.5	0.4
01129200	658	351	1048	Non-ref	0.14	57	9.48	20.2	0.47	35.1	0.6
01135150	8	348	1037	Ref	0.32	23	0.13	0.7	0.18	4.1	0.2
01138500	6848	122	895	n/a	0.22	64	148.58	337.6	0.44	73.6	4.6
01169000	231	140	1179	Ref	0.38	64	2.88	7.0	0.41	18.4	0.4
01175670	23	188	1162	Non-ref	0.23	53	0.30	1.1	0.28	4.4	0.2
01177000	1785	38	1101	Non-ref	0.16	64	25.30	52.1	0.49	50.5	1.0
01183500	1287	30	1139	Non-ref	0.24	64	8.48	32.6	0.26	55.8	0.6
01196500	298	6	1181	Non-ref	0.27	64	4.39	7.6	0.58	14.5	0.5
01200000	526	93	1129	Non-ref	0.21	58	6.82	12.8	0.53	24.7	0.5
01204000	195	50	1198	Non-ref	0.35	64	3.00	9.1	0.33	19.9	0.5
01206900	258	108	1218	Non-ref	0.34	53	2.98	14.5	0.21	33.4	0.4
01208925	74	5	1161	Non-ref	0.33	41	0.68	1.7	0.39	9.1	0.2
01208990	54	87	1226	Ref	0.28	49	0.67	1.7	0.39	5.6	0.3
01209700	78	35	1200	Non-ref	0.32	51	0.94	3.1	0.30	11.3	0.3
01315000	342	489	1091	Non-ref	0.08	64	5.63	12.4	0.45	19.7	0.6
01318500	4310	172	1066	Non-ref	0.13	64	45.65	145.7	0.31	94.1	1.5
01321000	1272	269	1151	Non-ref	0.22	64	15.81	43.5	0.36	63.9	0.7
01332500	326	186	1089	Non-ref	0.30	64	4.72	10.9	0.43	32.5	0.3
01334000	287	160	1024	Non-ref	0.29	64	5.48	11.3	0.48	25.9	0.4
01336000	394	144	1123	Non-ref	0.13	64	6.94	13.5	0.51	29.6	0.5
01350080	84	383	1026	Ref	0.34	27	0.96	2.4	0.40	7.4	0.3
01350120	28	319	1012	Non-ref	0.24	38	0.35	0.8	0.43	5.2	0.2
01364959	14	509	1280	Ref	0.35	13	0.38	2.4	0.16	7.8	0.3
01401650	14	18	1169	Non-ref	0.96	33	0.08	0.4	0.20	3.8	0.1
01403500	25	21	1207	Non-ref	0.76	35	0.15	0.9	0.17	5.6	0.2
01403535	4	59	1235	Non-ref	0.72	19	0.05	0.4	0.13	3.6	0.1
01409400	121	4	1112	Non-ref	0.11	56	2.29	5.0	0.46	10.9	0.5
01409500	176	0	1109	Non-ref	0.10	55	2.60	8.0	0.32	16.4	0.5
01409810	218	3	1114	Ref	0.15	28	3.15	6.0	0.52	11.0	0.5
01410150	21	0	1112	Non-ref	0.11	36	0.41	3.7	0.11	6.5	0.6
01411456	25	31	1116	Non-ref	0.21	25	0.31	1.4	0.23	5.1	0.3
01413500	422	397	1050	Ref	0.27	64	3.84	9.1	0.42	28.1	0.3
01429000	155	330	1073	Non-ref	0.26	64	1.70	6.0	0.28	18.4	0.3
01434000	7951	127	1094	Non-ref	0.22	64	76.45	176.4	0.43	184.4	1.0
01438500	9013	113	1089	Non-ref	0.21	64	56.83	264.2	0.21	162.6	1.6
01439500	303	128	1129	Ref	0.19	64	3.96	10.1	0.39	33.1	0.3
01440400	171	179	1141	Ref	0.26	56	2.48	8.9	0.28	24.2	0.4
01447500	238	446	1150	Non-ref	0.24	64	3.39	8.5	0.40	26.7	0.3
01447800	751	370	1120	Non-ref	0.23	56	9.00	21.0	0.43	46.5	0.5
01448500	6	508	1223	Ref	0.33	46	0.10	0.4	0.23	3.0	0.1
01449360	129	201	1159	Non-ref	0.19	47	2.38	7.1	0.33	19.6	0.4
01457500	16389	38	1143	Non-ref	0.16	21	182.05	332.9	0.53	134.2	2.5
01459500	252	79	1165	Non-ref	0.63	64	0.98	4.6	0.21	17.9	0.3
01465500	544	12	1153	Non-ref	0.59	64	4.92	12.0	0.41	35.8	0.3
01468500	344	143	1155	Non-ref	0.20	44	6.23	9.9	0.63	27.5	0.4
01470779	182	95	1110	Non-ref	0.19	39	2.56	8.4	0.31	20.5	0.4
01470960	453	70	1113	Non-ref	0.23	48	5.56	12.4	0.45	32.7	0.4
01471980	221	46	1123	Non-ref	0.39	29	2.41	7.3	0.33	26.1	0.3
01472157	153	49	1114	Non-ref	0.42	45	1.65	5.5	0.30	15.5	0.4
01473000	723	34	1103	Non-ref	0.60	64	7.51	21.2	0.35	53.6	0.4
01475300	13	94	1142	Non-ref	0.54	24	0.14	0.8	0.18	5.2	0.2
01477120	70	0	1101	Non-ref	0.36	47	0.84	2.9	0.29	9.8	0.3
01479000	231	2	1090	Non-ref	0.47	61	2.09	5.7	0.37	16.6	0.3
01480700	157	82	1140	Non-ref	0.35	48	1.47	5.7	0.26	18.5	0.3
01486000	12	2	1084	Ref	0.40	58	0.06	0.3	0.21	2.3	0.1
01488500	121	8	1103	Non-ref	0.34	59	0.89	5.0	0.18	15.6	0.3
01489000	18	5	1111	Non-ref	0.31	41	0.16	0.7	0.23	4.4	0.2
01490000	39	1	1105	Ref	0.27	41	0.35	2.5	0.14	6.5	0.4
01496000	63	35	1107	Non-ref	0.69	34	0.45	2.9	0.16	9.3	0.3

STAID	DA (km^2)	Elev. (m)	Precip. (mm/y)	Flow Ref. Condition	RBI	RBI (yrs)	Channel capacity $\overline{Q_{50}}$ (m^3/s)	$\overline{A_{50}}$ (m^2)	$\overline{V_{50}}$ (m/s)	$\overline{W_{50}}$ (m)	$\overline{D_{50}}$ (m)
01496200	23	66	1118	Non-ref	0.61	24	0.21	1.3	0.16	6.4	0.2
01513500	10207	244	917	n/a	0.19	21	89.84	234.9	0.38	187.6	1.3
01518700	1155	302	798	Non-ref	0.32	37	6.07	10.1	0.60	25.8	0.4
01527000	135	389	837	Ref	0.14	30	5.52	9.0	0.62	13.3	0.7
01533400	22585	183	920	Non-ref	0.20	37	184.30	313.7	0.59	254.6	1.2
01534300	100	473	1133	Non-ref	0.24	55	1.19	2.8	0.42	10.6	0.3
01541303	1228	333	1055	Non-ref	0.24	35	12.70	19.9	0.64	44.5	0.4
01548005	1456	171	995	Non-ref	0.19	45	12.58	27.4	0.46	49.7	0.6
01549500	98	318	915	Ref	0.35	64	0.76	2.3	0.33	9.6	0.2
01555500	420	122	1041	Non-ref	0.33	64	4.73	12.1	0.39	29.1	0.4
01560000	445	320	962	Non-ref	0.36	64	3.23	7.2	0.45	21.5	0.3
01563200	2486	182	972	Non-ref	0.25	64	12.71	31.5	0.40	57.5	0.5
01567000	8687	111	1026	Non-ref	0.20	64	78.18	199.9	0.39	156.3	1.3
01567500	39	183	1015	Ref	0.37	59	0.25	1.5	0.17	6.3	0.2
01568000	536	129	1024	Ref	0.37	64	4.83	13.9	0.35	31.8	0.4
01569800	56	123	1019	Non-ref	0.09	32	1.20	2.3	0.52	8.4	0.3
01570000	1217	107	1016	Non-ref	0.27	54	9.73	23.4	0.42	46.5	0.5
01581700	90	57	1131	Non-ref	0.41	46	0.93	3.3	0.28	11.1	0.3
01582500	414	74	1110	Non-ref	0.20	33	4.56	9.1	0.50	18.8	0.5
01583500	155	80	1111	Ref	0.29	64	1.47	4.0	0.37	11.7	0.3
01584050	24	74	1147	Non-ref	0.40	38	0.24	1.2	0.19	3.8	0.3
01584500	93	79	1148	Non-ref	0.35	35	0.91	3.1	0.30	11.1	0.3
01585400	5	3	1111	Non-ref	1.07	28	0.02	0.2	0.10	1.4	0.1
01590000	22	2	1073	Non-ref	0.30	24	0.20	1.6	0.12	5.1	0.3
01591400	59	114	1067	Ref	0.42	35	0.42	2.3	0.18	9.0	0.3
01594000	255	37	1081	Non-ref	0.51	40	1.82	7.3	0.25	18.5	0.4
01594526	232	1	1053	Non-ref	0.60	24	1.35	5.2	0.26	12.8	0.4
01594950	6	744	1237	Ref	0.37	27	0.07	0.3	0.26	2.2	0.1
01595800	689	351	983	Non-ref	0.24	28	7.61	26.4	0.29	43.1	0.6
01610000	8104	149	903	Non-ref	0.26	64	44.93	86.1	0.52	68.1	1.3
01614500	1279	119	985	Non-ref	0.27	64	7.84	18.7	0.42	36.8	0.5
01616000	44	160	956	Non-ref	0.27	24	0.42	1.6	0.25	6.6	0.3
01617800	49	108	974	Non-ref	0.14	50	0.26	1.0	0.25	4.5	0.2
01626000	329	395	1061	Non-ref	0.23	61	2.42	6.3	0.38	18.8	0.3
01627500	549	344	1020	Non-ref	0.24	46	4.05	7.8	0.52	21.6	0.4
01628500	2795	309	1005	Non-ref	0.24	64	15.17	31.8	0.48	62.0	0.5
01632900	242	269	927	Ref	0.30	53	1.15	3.2	0.36	12.0	0.3
01634500	264	197	930	Ref	0.42	64	1.09	3.9	0.28	15.4	0.3
01638500	24996	61	982	Non-ref	0.21	64	82.87	240.8	0.34	255.4	0.9
01640500	15	294	1073	Ref	0.35	34	0.15	0.7	0.21	3.4	0.2
01642500	213	82	989	Non-ref	0.40	32	1.28	4.3	0.30	12.2	0.4
01643700	316	101	1012	Ref	0.37	40	2.27	10.0	0.23	25.1	0.4
01644000	860	76	1002	Ref	0.40	64	3.80	11.0	0.35	23.3	0.5
01646000	150	46	1014	Non-ref	0.58	64	0.97	4.2	0.23	12.0	0.4
01653500	43	19	1025	Non-ref	0.67	28	0.28	1.2	0.24	6.5	0.2
01654000	62	58	1011	Non-ref	0.91	64	0.28	1.4	0.20	7.1	0.2
01656000	242	61	1012	Non-ref	0.68	60	0.75	2.7	0.28	11.1	0.2
01660920	207	10	1039	Non-ref	0.39	28	1.43	8.9	0.16	35.2	0.3
01661000	27	5	1063	Ref	0.50	22	0.18	0.5	0.35	3.5	0.1
01666500	464	86	1076	Ref	0.35	64	3.59	9.0	0.40	21.4	0.4
01667500	1212	74	1077	Ref	0.34	64	9.28	22.1	0.42	36.3	0.6
01671020	1197	13	1071	Non-ref	0.35	34	3.01	11.3	0.27	20.8	0.5
01673550	66	12	1089	Non-ref	0.32	36	0.42	1.4	0.31	5.9	0.2
01673800	201	56	1070	Non-ref	0.53	51	0.88	2.9	0.30	9.7	0.3
02022500	91	299	1016	Non-ref	0.45	64	0.34	3.4	0.10	11.8	0.3
02029000	11865	77	1095	Non-ref	0.23	64	80.83	209.4	0.39	161.3	1.3
02038850	22	144	1105	Ref	0.48	47	0.14	1.3	0.11	6.1	0.2
02039000	180	103	1093	Non-ref	0.34	64	1.20	3.7	0.33	12.7	0.3
02039500	782	86	1089	Non-ref	0.37	64	4.49	10.3	0.44	18.7	0.6
02040000	1878	53	1083	Non-ref	0.25	64	9.57	20.7	0.46	27.3	0.8
02041650	3476	21	1112	Non-ref	0.22	44	14.89	48.7	0.31	60.9	0.8
02045500	1494	18	1131	Non-ref	0.30	64	7.50	25.6	0.29	27.4	0.9
02046000	293	40	1114	Ref	0.43	64	1.02	3.4	0.30	11.0	0.3
02051000	145	102	1098	Ref	0.73	62	0.51	2.2	0.24	8.0	0.3
02052000	1927	20	1117	Non-ref	0.40	62	9.34	26.2	0.36	27.1	1.0
02053500	164	5	1199	Non-ref	0.44	61	0.50	2.2	0.22	7.5	0.3
02054530	728	335	994	Non-ref	0.36	22	3.55	10.4	0.34	28.6	0.4
02056650	145	251	1047	Non-ref	0.39	39	0.87	3.5	0.25	12.6	0.3
02056900	298	267	1097	Ref	0.33	37	2.30	8.2	0.28	20.1	0.4
02058400	909	188	1099	Non-ref	0.37	50	6.57	18.9	0.35	36.9	0.5
02064000	427	126	1085	Ref	0.44	64	2.51	8.1	0.31	19.5	0.4
02065500	253	113	1090	Ref	0.35	64	1.84	3.9	0.48	12.1	0.3
02066000	7682	94	1087	Non-ref	0.27	63	40.74	74.7	0.55	59.8	1.2
02069700	221	266	1206	Ref	0.27	51	2.46	6.5	0.38	17.2	0.4
02070500	627	210	1170	Ref	0.30	41	6.26	19.6	0.32	37.3	0.5
02071000	2727	156	1123	Non-ref	0.34	64	21.39	38.9	0.55	41.6	0.9
02073000	982	200	1154	Non-ref	0.34	64	13.84	23.7	0.58	53.9	0.4
02074000	1393	164	1128	Non-ref	0.34	64	9.52	34.2	0.28	48.8	0.7
02075500	6700	98	1091	Non-ref	0.28	63	49.72	78.5	0.63	60.0	1.3
02082770	430	39	1139	Ref	0.29	49	2.85	6.4	0.45	14.7	0.4
02083500	5654	3	1175	Non-ref	0.16	64	25.15	54.8	0.46	58.4	0.9
02083800	202	9	1202	Non-ref	0.31	45	1.21	3.9	0.31	8.0	0.5
02087500	2978	39	1164	Non-ref	0.25	64	11.05	29.2	0.38	39.2	0.7
02089000	6213	13	1240	Non-ref	0.13	64	37.61	86.3	0.44	58.0	1.5

STAID	DA (km^2)	Elev. (m)	Precip. (mm/y)	Flow Ref. Condition	RBI	RBI (yrs)	Channel capacity $\overline{Q_{50}}$ (m^3/s)	$\overline{A_{50}}$ (m^2)	$\overline{V_{50}}$ (m/s)	$\overline{W_{50}}$ (m)	$\overline{D_{50}}$ (m)
02091000	208	15	1226	Ref	0.37	59	1.38	6.8	0.20	12.2	0.6
02097517	106	73	1143	Non-ref	0.52	31	0.55	3.3	0.17	11.6	0.3
02102192	198	47	1157	Non-ref	0.31	41	0.24	2.1	0.11	7.7	0.3
02102908	20	58	1173	Ref	0.28	45	0.28	1.0	0.27	3.4	0.3
02103000	901	37	1174	Non-ref	0.20	11	7.75	16.2	0.48	18.8	0.9
02110500	2875	2	1295	Ref	0.06	63	17.52	117.1	0.15	58.1	2.0
02111000	75	369	1254	Non-ref	0.26	64	0.93	4.4	0.21	12.5	0.3
02111500	231	298	1243	Ref	0.26	64	2.55	7.3	0.35	21.6	0.3
02112120	332	294	1213	Ref	0.28	49	3.10	10.7	0.29	27.1	0.4
02112360	204	283	1190	Ref	0.24	49	2.82	10.0	0.28	18.0	0.6
02113000	332	277	1184	Non-ref	0.34	60	3.40	15.5	0.22	26.0	0.6
02114450	111	248	1178	Non-ref	0.55	53	0.72	2.1	0.34	8.8	0.2
02115360	4387	214	1147	Non-ref	0.23	49	54.60	82.8	0.66	70.1	1.2
02118000	793	202	1148	Non-ref	0.28	64	6.74	12.7	0.53	23.9	0.5
02118500	401	224	1174	Ref	0.34	63	4.29	9.1	0.47	19.4	0.5
02121500	451	188	1132	Non-ref	0.58	25	1.89	5.1	0.37	19.2	0.3
02123567	9	104	1166	Ref	0.63	19	0.04	0.4	0.12	2.5	0.1
02125000	144	130	1160	Ref	0.87	55	0.29	1.6	0.19	7.1	0.2
02128000	275	125	1177	Ref	0.67	59	1.24	4.6	0.27	15.6	0.3
02130561	19684	0	1165	Non-ref	0.26	23	145.13	300.4	0.48	82.6	3.6
02131000	22870	8	1180	Non-ref	0.13	64	184.58	334.4	0.55	101.3	3.3
02131309	63	92	1163	Non-ref	0.40	20	0.40	1.0	0.41	4.6	0.2
02132000	2668	18	1169	n/a	0.10	64	20.54	62.8	0.33	34.3	1.8
02135300	249	50	1152	Ref	0.16	34	1.69	8.0	0.21	12.4	0.6
02142000	73	326	1245	Ref	0.34	58	0.65	2.0	0.32	7.8	0.3
02143000	215	272	1227	Ref	0.35	64	2.51	9.0	0.28	24.5	0.4
02143040	67	336	1285	Ref	0.40	52	0.86	3.0	0.29	10.3	0.3
02144000	82	215	1197	Non-ref	0.54	61	0.49	1.5	0.32	6.3	0.2
02145000	1627	184	1172	Non-ref	0.27	50	12.10	35.7	0.34	49.7	0.7
02146300	80	180	1147	Non-ref	0.90	51	0.53	1.5	0.35	7.8	0.2
02146507	110	172	1149	Non-ref	0.83	36	1.12	3.9	0.28	12.6	0.3
02151500	2266	195	1280	Non-ref	0.26	64	34.09	56.1	0.61	77.1	0.7
02152100	157	274	1286	Ref	0.33	54	1.78	5.1	0.35	15.7	0.3
02153780	62	172	1226	Non-ref	0.51	21	0.26	1.4	0.19	4.9	0.3
02160105	1966	91	1214	Non-ref	0.25	40	19.46	40.3	0.48	41.9	1.0
02160700	1150	91	1215	Non-ref	0.27	40	10.21	21.4	0.48	31.5	0.7
02162093	15	61	1185	Non-ref	0.99	26	0.08	0.4	0.20	3.3	0.1
02162350	54	329	1475	Non-ref	0.23	22	1.20	3.9	0.31	9.4	0.4
02173000	1865	47	1201	Non-ref	0.06	54	15.55	41.0	0.38	32.3	1.3
02175000	7071	6	1278	Non-ref	0.06	64	49.44	136.8	0.36	74.1	1.8
02175500	883	20	1234	Non-ref	0.11	58	6.15	32.5	0.19	37.4	0.9
02186000	275	251	1432	Non-ref	0.30	28	3.70	7.3	0.51	14.2	0.5
02188500	99	177	1254	Non-ref	0.38	27	1.00	2.9	0.34	8.2	0.4
02191200	158	212	1380	Non-ref	0.37	19	2.08	4.9	0.43	12.3	0.4
02192000	3704	109	1191	Non-ref	0.27	64	30.21	55.2	0.55	58.3	0.9
02192500	562	108	1181	Ref	0.41	45	3.19	7.4	0.43	23.2	0.3
02198000	1673	29	1182	Non-ref	0.11	64	12.40	52.1	0.24	27.4	1.9
02198100	80	57	1172	Ref	0.42	27	0.18	0.9	0.20	4.5	0.2
02201000	282	80	1161	Non-ref	0.30	33	1.59	5.0	0.32	11.8	0.4
02202600	601	8	1224	Ref	0.26	30	0.47	1.5	0.32	6.3	0.2
02206500	347	246	1319	Non-ref	0.41	35	3.05	8.6	0.35	16.0	0.5
02212600	187	112	1209	Ref	0.64	48	0.53	1.9	0.27	9.2	0.2
02213050	81	116	1188	Ref	0.70	32	0.30	1.1	0.26	6.4	0.2
02215000	9842	58	1154	Non-ref	0.10	15	55.82	102.5	0.54	60.1	1.7
02215500	13416	27	1154	Non-ref	0.07	64	102.27	204.4	0.50	89.2	2.3
02216180	127	53	1157	Ref	0.42	31	0.87	2.3	0.37	5.4	0.4
02217475	860	200	1292	Non-ref	0.33	26	7.91	17.1	0.46	27.3	0.6
02220550	43	120	1188	Ref	0.71	25	0.15	0.7	0.22	3.7	0.2
02223500	11396	45	1149	Non-ref	0.16	64	59.36	87.7	0.68	64.6	1.4
02225000	30044	19	1174	Non-ref	0.07	44	137.50	384.1	0.36	137.8	2.8
02226000	35224	7	1261	Non-ref	0.06	64	118.91	224.3	0.53	110.8	2.0
02227000	360	42	1226	Ref	0.23	19	1.72	19.3	0.09	35.7	0.5
02231280	77	5	1317	Ref	0.41	38	0.26	2.6	0.10	5.8	0.4
02233500	624	3	1279	Non-ref	0.16	64	3.68	12.0	0.31	16.1	0.7
02234384	55	3	1246	Non-ref	0.30	30	0.15	0.8	0.19	3.7	0.2
02234400	33	5	1243	Non-ref	0.23	34	0.24	1.0	0.22	4.3	0.2
02236500	176	30	1275	Ref	0.10	55	0.32	2.1	0.15	7.0	0.3
02240500	3541	9	1313	Non-ref	0.03	35	23.91	82.4	0.29	26.4	3.1
02243000	2898	6	1313	Non-ref	0.14	56	0.56	3.2	0.18	8.8	0.4
02245140	123	1	1301	Non-ref	0.31	28	0.51	2.3	0.22	4.7	0.5
02245255	54	4	1295	Ref	0.44	31	0.07	0.6	0.12	3.6	0.2
02245500	347	3	1298	Ref	0.35	64	1.74	6.5	0.27	11.3	0.6
02266200	32	2	1239	Ref	0.10	44	0.16	1.5	0.10	4.4	0.4
02266480	60	24	1221	Non-ref	0.19	44	0.22	1.4	0.17	4.5	0.3
02269500	158	23	1242	Non-ref	0.03	21	0.80	2.6	0.31	9.0	0.3
02291580	75	2	1336	Non-ref	0.29	26	0.16	0.6	0.26	2.3	0.3
02294217	137	27	1220	Non-ref	0.19	17	0.37	0.9	0.42	4.7	0.2
02294650	1010	27	1283	Non-ref	0.09	64	1.62	8.4	0.19	13.1	0.6
02295420	313	16	1276	Non-ref	0.19	38	1.71	4.5	0.38	10.0	0.5
02297155	109	18	1302	Ref	0.34	36	0.25	1.0	0.25	5.2	0.2
02297310	565	3	1313	Ref	0.20	63	1.53	4.6	0.34	12.1	0.4
02298123	603	8	1283	Ref	0.14	40	1.23	4.0	0.31	11.0	0.4
02298202	966	0	1270	Non-ref	0.17	41	7.08	24.7	0.29	150.4	0.2
02298760	52	-3	1382	Non-ref	0.37	24	0.10	0.7	0.14	4.6	0.2

STAID	DA (km^2)	Elev. (m)	Precip. (mm/y)	Flow Ref. Condition	RBI	RBI (yrs)	Channel capacity $\overline{Q_{50}}$ (m^3/s)	$\overline{A_{50}}$ (m^2)	$\overline{V_{50}}$ (m/s)	$\overline{W_{50}}$ (m)	$\overline{D_{50}}$ (m)
02299950	169	12	1328	Ref	0.48	47	0.46	1.9	0.24	6.0	0.3
02300100	81	14	1266	Non-ref	0.39	50	0.44	1.9	0.24	5.0	0.4
02301300	277	12	1262	Non-ref	0.15	51	1.63	5.1	0.32	11.1	0.5
02301500	868	2	1248	Non-ref	0.18	64	4.36	7.1	0.61	14.7	0.5
02301750	42	3	1199	Non-ref	0.37	29	0.08	0.5	0.16	3.7	0.1
02306647	37	0	1209	Non-ref	0.38	28	0.68	1.5	0.44	13.9	0.1
02307000	91	0	1228	Non-ref	0.25	61	0.68	1.6	0.42	14.7	0.1
02307359	78	0	1283	Non-ref	0.22	63	0.18	1.0	0.17	3.9	0.3
02312000	1476	15	1339	Non-ref	0.06	64	2.02	10.1	0.20	14.6	0.7
02312200	376	18	1322	Ref	0.10	55	0.24	1.6	0.14	4.7	0.3
02314200	67	5	1373	Ref	0.32	28	0.07	0.3	0.20	1.8	0.2
02315000	5413	0	1342	Ref	0.06	30	7.40	17.8	0.42	33.2	0.5
02315500	6294	0	1336	Ref	0.06	64	16.16	58.5	0.28	37.0	1.6
02317500	3626	23	1306	Non-ref	0.09	64	7.90	16.1	0.49	26.1	0.6
02319000	5491	14	1316	Non-ref	0.11	64	16.83	103.2	0.16	51.4	2.0
02320500	20409	1	1214	Non-ref	0.02	64	130.58	282.2	0.46	83.1	3.4
02321000	495	26	1339	Ref	0.27	42	0.83	4.9	0.17	9.8	0.5
02324400	155	16	1423	Ref	0.15	58	0.32	2.4	0.14	5.8	0.4
02327100	264	0	1515	Ref	0.25	49	1.32	4.4	0.30	12.1	0.4
02327500	1424	41	1359	Non-ref	0.22	34	2.17	11.7	0.19	19.0	0.6
02329000	2953	18	1466	Non-ref	0.12	64	5.06	17.8	0.28	29.6	0.6
02330450	116	428	1656	Non-ref	0.20	32	2.84	7.2	0.40	17.2	0.4
02331000	388	372	1583	Ref	0.23	26	9.38	32.0	0.29	35.2	0.9
02333500	396	344	1573	Non-ref	0.26	64	7.60	16.2	0.47	26.4	0.6
02335000	3030	268	1372	Non-ref	0.27	57	25.74	77.3	0.33	60.3	1.3
02335450	3160	262	1354	Non-ref	0.29	37	26.02	99.3	0.26	65.9	1.5
02336000	3755	229	1314	Non-ref	0.25	64	34.82	100.3	0.35	71.7	1.4
02336300	225	233	1309	Non-ref	0.85	55	1.43	3.9	0.36	16.2	0.2
02336490	4118	224	1314	Non-ref	0.30	32	36.53	86.2	0.42	48.2	1.8
02337170	5335	219	1301	Non-ref	0.27	48	64.96	135.0	0.48	72.1	1.9
02338000	6294	208	1328	Non-ref	0.25	53	79.58	144.7	0.55	85.3	1.7
02346500	482	184	1280	Non-ref	0.28	21	3.54	18.6	0.19	22.6	0.8
02347500	4791	102	1214	Non-ref	0.23	64	33.29	74.3	0.45	67.9	1.1
02350900	1365	65	1233	Ref	0.16	28	10.24	26.2	0.39	28.3	0.9
02353000	14867	34	1309	Non-ref	0.12	57	129.09	229.1	0.56	83.2	2.8
02353400	487	65	1312	Non-ref	0.28	36	5.14	30.5	0.17	29.5	1.0
02357000	1365	26	1363	Non-ref	0.13	53	5.70	19.2	0.30	24.1	0.8
02363000	1290	75	1360	Ref	0.23	46	6.71	14.5	0.46	32.5	0.4
02365500	9062	12	1513	Non-ref	0.13	59	87.77	309.9	0.28	90.3	3.4
02368000	1616	14	1543	Non-ref	0.16	60	18.72	45.1	0.41	33.2	1.4
02369000	1228	14	1536	Non-ref	0.18	64	18.31	37.0	0.49	32.4	1.1
02370500	614	3	1566	Non-ref	0.22	54	13.49	27.9	0.48	33.9	0.8
02371500	1295	69	1441	Ref	0.18	64	8.31	19.6	0.42	23.2	0.8
02373000	1217	48	1525	Ref	0.29	56	6.23	11.0	0.56	23.3	0.5
02374500	456	54	1553	Ref	0.25	64	5.11	23.8	0.22	20.4	1.2
02377570	497	8	1581	Non-ref	0.31	26	7.05	17.2	0.41	27.1	0.6
02380500	611	371	1549	Non-ref	0.20	50	11.10	21.5	0.52	36.9	0.6
02381600	26	400	1542	Ref	0.35	38	0.31	1.6	0.20	6.6	0.2
02382200	308	272	1456	Non-ref	0.34	40	3.26	8.3	0.39	20.7	0.4
02383500	2152	188	1377	Non-ref	0.21	64	31.97	52.8	0.61	36.9	1.4
02384500	653	205	1403	Non-ref	0.41	32	6.75	19.5	0.35	29.0	0.7
02387500	4149	184	1373	Non-ref	0.21	64	48.28	99.7	0.48	39.8	2.5
02388500	5478	171	1360	Non-ref	0.18	63	57.89	138.6	0.42	61.4	2.3
02392000	1588	257	1410	Non-ref	0.21	64	26.82	43.0	0.62	37.0	1.2
02397000	10464	169	1367	Non-ref	0.18	60	118.31	351.0	0.34	86.9	4.0
02398000	497	187	1390	Non-ref	0.35	63	5.20	10.0	0.52	19.3	0.5
02398300	948	171	1397	Non-ref	0.29	37	7.88	9.5	0.83	21.1	0.5
02406500	388	131	1410	Non-ref	0.30	27	3.46	8.9	0.39	23.3	0.4
02408540	681	115	1429	Ref	0.43	33	4.64	13.8	0.33	26.9	0.5
02411930	704	283	1425	Non-ref	0.34	12	5.41	7.9	0.69	18.7	0.4
02412000	1160	253	1441	Non-ref	0.30	61	9.52	15.9	0.60	27.8	0.6
02414500	4338	183	1436	Non-ref	0.34	64	5.82	29.5	0.20	82.9	0.4
02419000	862	68	1377	Non-ref	0.37	59	2.20	4.8	0.46	16.3	0.3
02421000	751	46	1315	Non-ref	0.59	55	0.84	2.7	0.31	12.3	0.2
02422500	526	50	1386	Ref	0.39	59	3.97	7.7	0.51	20.2	0.4
02423400	63	170	1419	Non-ref	0.51	19	0.69	2.8	0.25	10.9	0.3
02424590	3833	30	1372	Non-ref	0.24	23	28.21	84.1	0.34	36.0	2.3
02425000	4574	26	1352	Non-ref	0.22	49	31.56	60.8	0.52	43.9	1.4
02427250	676	39	1382	Ref	0.53	24	2.10	8.4	0.25	20.2	0.4
02429900	70	100	1413	Non-ref	0.61	29	0.34	1.2	0.29	5.1	0.2
02430615	29	95	1438	Ref	0.49	35	0.28	1.1	0.26	5.3	0.2
02436500	1606	59	1401	Non-ref	0.72	64	7.90	24.5	0.32	38.5	0.6
02438000	717	110	1483	Ref	0.47	42	5.35	14.3	0.37	28.2	0.5
02446500	1368	60	1428	Non-ref	0.17	56	8.49	32.3	0.26	26.2	1.2
02448900	409	32	1399	Ref	0.79	23	0.37	2.1	0.18	7.1	0.3
02449245	112	32	1390	Non-ref	0.75	21	0.37	1.9	0.20	8.0	0.2
02450250	239	165	1478	Ref	0.58	47	1.14	5.6	0.20	16.6	0.3
02453000	469	122	1466	Non-ref	0.30	48	3.30	12.0	0.27	21.8	0.6
02464360	148	69	1455	Ref	0.48	27	1.24	5.2	0.24	14.4	0.4
02465493	84	45	1397	Ref	0.30	37	0.70	2.8	0.25	7.5	0.4
02469800	425	12	1507	Ref	0.48	52	2.29	6.5	0.35	12.7	0.5
02471001	324	1	1600	Non-ref	0.36	62	4.33	11.0	0.39	20.8	0.5
02476600	886	79	1411	Non-ref	0.28	45	4.86	12.3	0.40	21.6	0.6
02477000	2378	63	1425	Non-ref	0.29	64	14.97	18.4	0.81	17.4	1.1

STAID	DA (km^2)	Elev. (m)	Precip. (mm/y)	Flow Ref. Condition	RBI	RBI (yrs)	Channel capacity $\overline{Q_{50}}$ (m^3/s)	$\overline{A_{50}}$ (m^2)	$\overline{V_{50}}$ (m/s)	$\overline{W_{50}}$ (m)	$\overline{D_{50}}$ (m)
02477990	1274	43	1518	Non-ref	0.24	41	8.60	12.6	0.68	21.9	0.6
02479000	17068	8	1614	Non-ref	0.14	64	119.61	279.3	0.43	117.4	2.4
02479155	136	31	1600	Ref	0.63	47	1.06	3.5	0.30	10.7	0.3
02479300	1142	6	1638	Ref	0.27	52	13.93	39.8	0.35	33.8	1.2
02479560	1456	14	1622	Ref	0.24	40	14.22	56.9	0.25	35.4	1.6
02481510	798	4	1616	Ref	0.42	42	6.39	13.3	0.48	26.3	0.5
02484000	785	114	1450	Non-ref	0.41	64	1.90	7.9	0.24	16.6	0.5
02489500	17024	17	1591	Non-ref	0.09	64	89.14	253.8	0.35	95.3	2.7
03022540	81	373	1116	Ref	0.48	20	0.78	2.6	0.29	11.8	0.2
03028000	163	458	1129	Ref	0.28	60	2.21	4.6	0.48	16.5	0.3
03039000	720	244	1029	Non-ref	0.26	44	3.09	8.0	0.39	24.2	0.3
03056250	251	305	1159	Non-ref	0.48	29	2.26	7.0	0.32	15.8	0.4
03065400	142	954	1328	Ref	0.35	17	2.17	7.0	0.31	21.9	0.3
03076600	127	473	1135	Ref	0.31	49	1.33	3.5	0.38	10.9	0.3
03080000	313	407	1083	Non-ref	0.34	64	3.56	11.0	0.32	35.3	0.3
03083000	8	382	1095	Ref	0.49	29	0.07	0.4	0.16	2.6	0.2
03084000	11	286	1011	Non-ref	0.56	43	0.04	0.3	0.16	2.6	0.1
03102500	269	291	1019	Non-ref	0.42	64	1.56	4.5	0.34	18.0	0.3
03102850	873	279	1001	Non-ref	0.24	48	6.42	12.9	0.50	32.6	0.4
03106000	922	260	954	Non-ref	0.38	64	4.04	11.2	0.36	29.0	0.4
03106500	1031	254	972	Non-ref	0.31	64	6.71	12.8	0.52	31.4	0.4
03131500	904	283	973	Non-ref	0.19	41	39.78	48.9	0.81	28.6	1.7
03144000	363	228	1002	Ref	0.45	64	1.26	5.6	0.22	21.2	0.3
03151400	290	259	1242	Non-ref	0.47	37	2.88	6.8	0.42	22.4	0.3
03153500	2365	199	1136	Non-ref	0.50	28	15.42	29.8	0.52	39.0	0.8
03167000	668	587	983	Non-ref	0.28	64	4.65	15.0	0.31	32.7	0.5
03168000	5729	563	995	Non-ref	0.23	64	58.43	230.9	0.25	137.1	1.7
03173000	774	508	933	Ref	0.32	64	4.58	14.7	0.31	33.9	0.4
03185400	17319	314	1084	Non-ref	0.23	32	138.15	259.8	0.53	105.8	2.5
03190000	743	570	1172	Ref	0.29	21	20.06	40.9	0.49	33.4	1.2
03208500	741	377	1133	Non-ref	0.49	64	3.75	13.3	0.28	33.5	0.4
03209200	1362	355	1138	Non-ref	0.41	19	9.67	17.2	0.56	49.9	0.3
03216600	160579	144	1039	n/a	0.17	44	2119.03	2600.9	0.82	431.6	6.0
03217000	627	167	1054	Non-ref	0.56	64	2.82	5.2	0.54	16.6	0.3
03228805	316	251	964	Non-ref	0.40	50	0.42	2.3	0.19	8.8	0.3
03234000	2090	203	1009	Non-ref	0.32	52	24.66	52.6	0.47	56.7	0.9
03249500	2142	197	1169	Non-ref	0.23	45	6.90	19.2	0.36	33.7	0.6
03251200	585	194	1117	Ref	0.55	22	3.30	4.6	0.71	11.9	0.4
03251500	6024	159	1103	Non-ref	0.27	57	34.81	59.7	0.58	56.2	1.1
03252000	619	235	1139	Non-ref	0.57	36	1.86	8.5	0.22	27.6	0.3
03252300	399	240	1150	Ref	0.59	18	2.12	7.3	0.29	15.2	0.5
03277500	1207	256	1190	Non-ref	0.49	43	7.04	15.6	0.45	48.5	0.3
03282000	6882	191	1207	Non-ref	0.32	63	69.86	340.2	0.21	81.0	4.2
03289000	62	254	1154	Non-ref	0.46	55	0.35	1.6	0.21	8.1	0.2
03289300	272	243	1136	Non-ref	0.40	30	2.89	5.6	0.51	15.9	0.4
03291500	1132	155	1101	Non-ref	0.80	38	3.32	6.7	0.49	18.3	0.4
03291780	71	180	1110	Ref	0.85	44	0.24	1.2	0.20	6.8	0.2
03294000	490	131	1131	Non-ref	0.62	59	1.74	6.3	0.28	14.1	0.4
03294550	63	133	1130	Non-ref	1.34	19	0.05	0.8	0.06	4.3	0.2
03295000	107	247	1217	Non-ref	0.87	20	0.23	1.3	0.18	5.9	0.2
03295890	671	142	1175	Non-ref	0.59	32	2.98	8.5	0.35	25.2	0.3
03298300	17	159	1169	Non-ref	0.79	14	0.09	1.2	0.08	6.5	0.2
03298500	3100	124	1168	Non-ref	0.46	57	9.66	21.0	0.46	49.0	0.4
03301900	9	170	1159	Non-ref	0.66	16	0.09	0.6	0.16	4.6	0.1
03302300	42	214	1152	Non-ref	0.75	34	0.16	0.7	0.22	6.0	0.1
03304500	6	295	1283	Ref	0.71	19	0.04	0.2	0.18	2.1	0.1
03310000	99	211	1274	Non-ref	0.65	25	0.33	1.4	0.24	7.6	0.2
03310400	221	173	1288	Ref	0.37	36	1.02	2.4	0.42	7.4	0.3
03311500	7154	126	1280	Non-ref	0.20	42	68.26	216.8	0.31	63.5	3.4
03319000	1961	120	1231	Non-ref	0.25	43	13.27	25.0	0.53	21.7	1.2
03322900	1173	246	922	Non-ref	0.35	49	4.82	13.5	0.36	30.0	0.5
03330500	293	253	980	Non-ref	0.07	64	2.75	5.8	0.47	16.5	0.4
03331500	2217	211	967	Non-ref	0.09	64	27.89	80.5	0.35	68.4	1.2
03333450	378	250	981	Non-ref	0.43	52	2.85	8.6	0.33	16.9	0.5
03335000	2056	161	943	Non-ref	0.27	59	13.08	20.3	0.65	36.5	0.6
03336900	347	198	952	Non-ref	0.41	40	2.35	7.4	0.32	15.6	0.5
03339500	1318	200	1030	Non-ref	0.41	64	6.46	15.9	0.41	34.1	0.5
03341500	31761	136	1022	Non-ref	0.11	64	245.96	451.9	0.54	168.2	2.7
03342000	34087	126	1055	Non-ref	0.09	64	183.93	301.7	0.61	152.7	2.0
03353800	549	196	1034	Non-ref	0.52	56	3.31	10.8	0.31	26.0	0.4
03360000	2150	167	1075	Non-ref	0.31	64	12.07	23.9	0.51	35.3	0.7
03360500	12142	142	1109	Non-ref	0.16	64	105.84	155.7	0.68	93.9	1.7
03361500	1090	225	1029	Non-ref	0.31	64	9.59	16.1	0.60	32.1	0.5
03361650	243	240	1032	Non-ref	0.33	46	1.73	4.7	0.37	12.4	0.4
03361850	204	231	1026	Non-ref	0.55	46	0.68	3.2	0.22	11.5	0.3
03363500	785	233	1050	Non-ref	0.36	64	3.03	5.4	0.56	19.1	0.3
03369500	513	178	1099	Non-ref	0.82	64	2.00	6.1	0.33	21.0	0.3
03374000	28814	122	1117	Non-ref	0.10	64	243.18	398.2	0.61	141.1	2.8
03376500	2129	119	1122	Non-ref	0.11	64	20.85	32.9	0.63	22.9	1.4
03379500	2929	120	1060	Non-ref	0.35	64	5.76	19.5	0.30	21.0	0.9
03402000	157	335	1302	Non-ref	0.56	55	1.27	2.5	0.50	10.8	0.2
03409500	704	330	1358	Ref	0.51	51	5.14	12.3	0.42	26.9	0.5
03415000	298	209	1340	Ref	0.54	30	1.00	3.8	0.26	12.5	0.3
03416000	275	216	1326	Ref	0.50	45	1.49	5.1	0.29	18.1	0.3

STAID	DA (km^2)	Elev. (m)	Precip. (mm/y)	Flow Ref. Condition	RBI	RBI (yrs)	Channel capacity $\overline{Q_{50}}$ (m^3/s)	$\overline{A_{50}}$ (m^2)	$\overline{V_{50}}$ (m/s)	$\overline{W_{50}}$ (m)	$\overline{D_{50}}$ (m)
03427500	679	155	1327	Ref	0.69	41	2.61	6.4	0.41	14.9	0.4
03428200	458	157	1292	Non-ref	0.57	37	2.53	7.9	0.32	19.6	0.4
03432400	544	189	1298	Non-ref	0.49	14	2.19	5.0	0.44	12.5	0.4
03433500	1059	165	1277	Non-ref	0.47	64	4.57	10.4	0.44	27.4	0.4
03436100	2398	115	1262	Non-ref	0.31	46	19.23	26.9	0.72	40.0	0.7
03443000	767	628	1489	Non-ref	0.18	64	21.58	42.3	0.51	32.4	1.3
03446000	173	637	1302	Non-ref	0.20	64	3.86	8.8	0.44	20.1	0.4
03448500	207	630	1160	Non-ref	0.22	27	2.29	5.9	0.39	17.1	0.3
03453500	3450	502	1082	Non-ref	0.17	64	53.14	105.7	0.50	98.9	1.1
03471500	198	642	1141	Ref	0.25	64	1.99	5.4	0.37	16.9	0.3
03473000	785	546	1151	Ref	0.25	64	7.93	19.1	0.42	32.7	0.6
03479000	239	795	1329	Ref	0.35	64	2.93	6.1	0.48	18.4	0.3
03500240	148	615	1563	Ref	0.23	52	3.00	6.2	0.49	14.5	0.4
03531500	826	384	1217	Non-ref	0.38	64	7.45	22.9	0.33	36.5	0.6
03545000	118	589	1664	Ref	0.20	32	3.25	5.2	0.63	12.4	0.4
03558000	458	543	1600	Ref	0.17	46	10.86	23.6	0.46	30.9	0.8
03559000	603	469	1544	Non-ref	0.30	24	37.79	49.3	0.77	32.0	1.5
03592718	64	131	1414	Ref	0.63	39	0.51	2.0	0.25	7.1	0.3
03603000	6623	113	1366	Non-ref	0.23	53	50.26	103.5	0.49	72.2	1.4
03604400	1818	124	1378	Non-ref	0.24	49	28.39	38.2	0.74	36.4	1.0
03611260	38	105	1249	Non-ref	1.10	42	0.06	0.3	0.19	2.9	0.1
04015330	217	197	726	Ref	0.43	39	1.63	5.8	0.28	18.4	0.3
04024098	20	252	746	Ref	0.51	25	0.08	0.3	0.28	1.9	0.1
04024430	1088	183	716	Ref	0.27	40	8.44	19.0	0.44	21.5	0.9
04027500	780	201	794	Non-ref	0.13	64	7.54	11.6	0.65	25.5	0.5
04033000	425	453	829	Ref	0.08	58	5.06	8.2	0.62	13.6	0.6
04036000	420	393	891	Non-ref	0.10	64	3.04	14.7	0.21	25.9	0.6
04037500	131	510	847	Non-ref	0.16	64	1.06	2.7	0.38	10.8	0.3
04056500	2849	185	793	Ref	0.05	64	31.69	52.0	0.61	45.2	1.1
04059500	1165	208	769	Ref	0.11	59	6.40	10.4	0.61	27.4	0.4
04065722	7511	250	773	Non-ref	0.09	26	64.56	119.9	0.54	104.0	1.2
04071858	347	178	767	Ref	0.30	23	0.86	4.4	0.19	15.8	0.3
04072150	280	184	748	Non-ref	0.41	25	0.67	2.2	0.31	7.5	0.3
04073500	3471	227	784	Non-ref	0.03	64	34.50	95.0	0.36	49.8	1.9
04074950	1199	381	800	Ref	0.06	45	11.28	26.1	0.43	45.2	0.6
04079000	5853	228	785	Non-ref	0.05	64	55.16	180.7	0.31	67.4	2.7
04085281	285	178	756	Ref	0.24	23	1.14	3.7	0.31	11.9	0.3
04085427	1362	180	763	Non-ref	0.10	39	3.70	12.1	0.31	24.5	0.5
04086500	311	242	805	Non-ref	0.21	53	2.85	10.0	0.28	22.9	0.4
04086600	1572	199	794	Non-ref	0.14	32	8.58	18.1	0.47	54.1	0.3
04087000	1803	185	805	Non-ref	0.17	64	13.90	27.5	0.51	51.1	0.5
04087204	65	192	826	Non-ref	0.60	50	0.43	1.5	0.29	8.0	0.2
04087220	127	205	830	Non-ref	0.53	50	1.31	2.9	0.45	8.2	0.4
04093000	321	179	944	Non-ref	0.29	64	1.35	7.4	0.18	15.3	0.5
04099750	935	248	916	Non-ref	0.06	45	8.67	16.1	0.54	25.8	0.6
04100222	368	268	935	Non-ref	0.06	42	2.65	7.8	0.34	13.2	0.6
04101500	9495	193	978	Non-ref	0.08	64	92.52	143.3	0.65	70.1	2.0
04102700	217	186	929	Non-ref	0.17	47	1.97	6.3	0.31	10.4	0.6
04105000	624	251	885	Non-ref	0.11	64	4.78	11.6	0.41	26.7	0.4
04106300	58	248	914	Non-ref	0.10	44	1.09	2.6	0.43	8.7	0.3
04108600	185	213	925	Non-ref	0.22	48	1.30	4.9	0.27	9.8	0.5
04109000	451	274	810	Non-ref	0.11	64	3.36	7.6	0.45	14.2	0.5
04111379	422	265	783	Non-ref	0.14	23	2.54	10.7	0.24	15.9	0.7
04115265	103	242	834	Ref	0.18	26	0.78	3.1	0.25	9.4	0.3
04117500	997	240	870	Non-ref	0.11	64	6.61	13.4	0.49	34.7	0.4
04118500	606	190	879	Non-ref	0.10	55	6.14	10.9	0.56	24.2	0.5
04122100	43	180	843	Non-ref	0.21	48	0.37	1.5	0.24	5.3	0.3
04135700	1039	326	757	Non-ref	0.04	45	5.93	10.5	0.56	23.0	0.5
04137500	4504	178	747	Non-ref	0.09	26	37.61	71.4	0.53	52.3	1.4
04142000	829	198	745	Non-ref	0.14	64	8.06	15.4	0.52	22.0	0.7
04148140	257	228	759	Non-ref	0.17	48	1.28	4.1	0.31	10.3	0.4
04148440	141	233	759	n/a	0.21	14	6.94	15.6	0.44	12.5	1.2
04148500	2476	207	759	Non-ref	0.16	64	13.25	27.7	0.48	37.7	0.7
04150500	930	213	753	Ref	0.32	56	3.40	9.9	0.34	23.6	0.4
04152238	414	216	771	Non-ref	0.18	27	2.72	8.5	0.32	16.4	0.5
04154000	1077	217	783	Non-ref	0.10	64	7.36	15.3	0.48	29.3	0.5
04155500	1010	190	771	Non-ref	0.17	60	6.97	25.4	0.28	50.1	0.5
04159900	438	217	768	Non-ref	0.28	37	0.83	5.1	0.16	14.3	0.4
04160600	391	215	778	Non-ref	0.31	51	1.23	4.9	0.25	11.8	0.4
04160900	205	287	783	Non-ref	0.07	49	1.47	2.5	0.58	9.9	0.3
04161540	184	230	786	Non-ref	0.16	54	1.23	3.1	0.40	9.8	0.3
04164100	56	236	782	Non-ref	0.16	55	0.42	1.9	0.22	7.0	0.3
04166100	228	186	790	Non-ref	0.46	55	1.17	4.6	0.25	8.8	0.5
04170000	342	268	779	Non-ref	0.09	61	3.00	6.6	0.45	13.6	0.5
04170500	383	265	783	Non-ref	0.08	64	3.05	6.9	0.44	21.8	0.3
04175600	342	274	832	Non-ref	0.09	40	2.67	4.6	0.59	10.1	0.5
04178000	1580	242	882	Non-ref	0.17	64	8.43	38.4	0.22	34.2	1.1
04182000	1974	228	911	Non-ref	0.29	64	7.78	18.0	0.43	37.4	0.5
04185440	11	231	874	Ref	0.94	23	0.02	0.2	0.16	1.8	0.1
04195500	1109	187	856	Non-ref	0.50	64	3.10	9.2	0.34	27.4	0.3
04207200	217	267	972	Non-ref	0.45	51	1.41	2.5	0.56	17.6	0.1
04213000	453	186	1015	Ref	0.52	63	4.03	6.2	0.66	18.2	0.3
04224775	230	218	802	Ref	0.36	38	1.67	4.2	0.39	14.3	0.3
04229500	508	186	806	Non-ref	0.28	60	1.73	4.8	0.36	16.7	0.3

STAID	DA (km^2)	Elev. (m)	Precip. (mm/y)	Flow Ref. Condition	RBI	RBI (yrs)	Channel capacity $\overline{Q_{50}}$ (m^3/s)	$\overline{A_{50}}$ (m^2)	$\overline{V_{50}}$ (m/s)	$\overline{W_{50}}$ (m)	$\overline{D_{50}}$ (m)
04230380	101	301	899	Non-ref	0.43	50	0.69	2.1	0.33	12.3	0.2
04230500	518	171	798	Non-ref	0.22	64	3.49	10.8	0.32	28.1	0.4
04231000	337	168	797	Non-ref	0.26	64	1.37	4.2	0.33	15.0	0.3
04235250	264	159	849	Non-ref	0.29	46	1.04	2.4	0.44	10.5	0.2
04250750	355	160	1047	Non-ref	0.36	48	3.74	8.9	0.42	20.5	0.4
04258000	754	246	1053	Non-ref	0.17	64	15.72	44.1	0.36	40.1	1.1
04265000	862	107	926	Ref	0.17	27	14.19	22.3	0.63	38.9	0.6
04267500	2427	269	1000	Non-ref	0.17	52	55.10	52.5	1.05	61.3	0.9
04270200	239	53	896	Non-ref	0.30	47	1.85	10.2	0.18	20.7	0.5
04271815	130	35	817	Non-ref	0.24	23	1.16	2.7	0.44	8.5	0.3
04276842	134	76	905	Ref	0.24	23	1.41	3.8	0.37	10.8	0.4
04293000	339	177	1030	n/a	0.41	64	4.63	14.6	0.32	24.8	0.6
05046000	4507	314	579	Non-ref	0.04	64	10.17	19.0	0.54	40.5	0.5
05050000	3004	296	546	Non-ref	0.15	64	3.06	10.4	0.29	21.4	0.5
05059000	22792	282	510	Non-ref	0.08	64	19.20	34.2	0.56	17.8	1.9
05061500	1176	275	539	Non-ref	0.23	58	2.71	17.7	0.15	18.2	1.0
05062500	2419	307	581	Ref	0.10	57	7.58	14.6	0.52	18.6	0.8
05064900	414	357	503	Ref	0.32	38	0.12	0.6	0.19	4.5	0.1
05076000	2551	339	534	Non-ref	0.14	62	6.31	15.8	0.40	22.6	0.7
05078230	658	343	570	Non-ref	0.21	51	2.14	10.0	0.21	14.8	0.7
05082500	77959	237	500	n/a	0.07	64	270.02	331.1	0.82	78.6	4.2
05087500	660	253	488	Ref	0.22	61	1.00	3.1	0.32	7.5	0.4
05094000	1093	283	490	Non-ref	0.24	55	1.79	5.4	0.34	15.5	0.3
05101000	414	283	476	Non-ref	0.19	30	0.30	1.2	0.26	3.8	0.3
05116500	2432	498	422	Non-ref	0.25	64	0.21	1.3	0.16	5.0	0.3
05129115	2344	360	695	Ref	0.05	34	18.38	63.0	0.29	38.4	1.6
05130500	466	398	679	Ref	0.11	60	3.24	10.4	0.31	19.9	0.5
05220500	13105	367	706	Non-ref	0.03	40	71.65	91.9	0.78	54.0	1.7
05227500	15903	360	717	Non-ref	0.03	64	60.70	147.0	0.41	51.6	2.8
05242300	18959	350	691	Non-ref	0.04	26	90.00	140.7	0.64	50.6	2.8
05291000	1031	304	571	Ref	0.29	64	0.34	1.2	0.27	5.8	0.2
05293000	1189	291	578	Ref	0.23	61	0.55	2.6	0.21	9.7	0.3
05315000	671	363	640	Non-ref	0.16	64	0.88	2.1	0.42	8.3	0.2
05330000	41958	210	727	Non-ref	0.06	64	182.86	247.4	0.74	71.3	3.5
05336700	2248	284	760	Non-ref	0.14	46	12.57	24.7	0.51	36.9	0.7
05338500	2523	289	765	Non-ref	0.10	52	9.42	24.4	0.39	63.1	0.4
05368000	1083	271	807	Non-ref	0.14	63	12.26	21.4	0.57	31.8	0.7
05374000	2978	247	793	Non-ref	0.32	30	58.50	64.3	0.91	48.3	1.3
05379400	1430	219	823	Non-ref	0.14	18	8.70	18.7	0.47	43.5	0.4
05379500	1665	202	822	Non-ref	0.12	64	16.75	30.6	0.55	29.9	1.0
05381000	1940	293	808	Non-ref	0.31	62	15.24	33.3	0.46	47.8	0.7
05391000	1961	478	795	Non-ref	0.04	64	13.41	43.1	0.31	52.8	0.8
05404000	20953	244	807	Non-ref	0.10	64	199.29	465.4	0.43	145.9	3.2
05408000	689	238	811	Ref	0.23	64	4.75	11.4	0.42	21.5	0.5
05412500	4002	193	834	Ref	0.22	64	17.63	33.2	0.53	44.3	0.8
05413500	697	185	836	Ref	0.26	64	6.07	9.3	0.65	11.5	0.8
05414500	337	187	856	Ref	0.58	32	0.97	4.5	0.22	12.6	0.4
05418500	4022	191	882	Non-ref	0.20	64	25.24	44.0	0.57	55.8	0.8
05419000	640	180	877	Non-ref	0.39	64	2.73	5.5	0.49	16.5	0.3
05420560	247	344	848	Ref	0.43	33	0.81	2.4	0.33	7.6	0.3
05427718	191	265	798	Non-ref	0.25	27	0.58	1.6	0.35	5.3	0.3
05431022	109	279	884	Non-ref	0.27	25	0.43	1.3	0.34	5.0	0.3
05437500	16480	216	869	Non-ref	0.06	64	121.15	175.4	0.69	158.8	1.1
05440700	20694	203	903	Non-ref	0.06	13	177.47	327.3	0.54	177.1	1.8
05448000	162	172	897	Non-ref	0.55	59	0.56	1.5	0.38	7.3	0.2
05451900	145	240	882	Non-ref	0.52	64	0.74	2.0	0.37	8.8	0.2
05452000	521	238	881	Non-ref	0.43	64	1.65	4.1	0.40	12.1	0.3
05453000	490	227	888	Non-ref	0.46	64	1.94	4.8	0.40	17.4	0.3
05454500	8472	188	905	Non-ref	0.11	64	45.16	75.5	0.60	64.3	1.2
05455500	1487	193	897	Non-ref	0.40	64	4.31	12.1	0.36	24.9	0.5
05457700	2730	297	846	Non-ref	0.20	43	11.94	23.4	0.51	51.5	0.5
05459000	777	359	811	Non-ref	0.12	36	2.92	9.5	0.31	25.5	0.4
05463000	899	269	858	Non-ref	0.26	64	4.27	10.0	0.42	21.5	0.5
05463500	785	264	867	Non-ref	0.28	54	3.24	8.8	0.37	18.8	0.5
05464500	16861	214	881	Non-ref	0.11	64	84.30	128.2	0.66	150.0	0.9
05465000	20168	177	915	Non-ref	0.10	64	126.22	178.6	0.71	130.7	1.4
05465500	32375	164	897	Non-ref	0.09	64	249.85	336.4	0.74	137.5	2.4
05466500	1153	162	887	Ref	0.27	64	6.41	15.1	0.42	22.4	0.7
05469000	1119	165	901	Non-ref	0.32	62	5.59	14.8	0.38	18.4	0.8
05471050	2080	235	873	Non-ref	0.19	26	14.23	27.2	0.52	52.8	0.5
05473400	1373	172	918	Non-ref	0.48	36	3.69	10.5	0.35	22.7	0.5
05473500	275	192	914	Ref	0.61	23	0.77	2.4	0.33	10.7	0.2
05478000	1197	340	765	Non-ref	0.15	22	2.56	6.9	0.37	18.8	0.4
05479000	3388	317	800	Non-ref	0.12	64	7.23	17.1	0.42	43.1	0.4
05480000	666	329	811	Non-ref	0.26	32	0.96	4.0	0.24	13.1	0.3
05481000	2186	302	813	Non-ref	0.22	64	5.92	15.3	0.39	36.6	0.4
05481300	14121	272	823	Non-ref	0.12	46	66.72	98.2	0.68	84.1	1.2
05482300	1813	349	795	Non-ref	0.21	55	9.87	20.0	0.49	36.6	0.5
05484000	2574	271	831	Non-ref	0.32	64	11.08	24.0	0.46	47.4	0.5
05485640	240	243	843	Non-ref	0.40	42	1.34	3.2	0.41	13.9	0.2
05487500	30186	213	897	Non-ref	0.11	23	146.38	235.0	0.62	120.1	2.0
05488200	233	220	1000	Ref	0.77	28	0.41	1.3	0.31	5.9	0.2
05490500	36358	167	935	Non-ref	0.14	64	233.11	259.9	0.90	168.4	1.5
05495000	1036	153	963	Ref	0.61	64	1.32	5.4	0.24	17.0	0.3

STAID	DA (km^2)	Elev. (m)	Precip. (mm/y)	Flow Ref. Condition	RBI	RBI (yrs)	Channel capacity $\overline{Q_{50}}$ (m^3/s)	$\overline{A_{50}}$ (m^2)	$\overline{V_{50}}$ (m/s)	$\overline{W_{50}}$ (m)	$\overline{D_{50}}$ (m)
05496000	1018	158	972	Non-ref	0.59	56	1.42	4.0	0.35	12.9	0.3
05497000	1171	165	962	Non-ref	0.64	55	1.03	4.1	0.25	15.2	0.3
05498000	1018	165	959	Ref	0.54	55	0.78	2.5	0.31	9.6	0.3
05507600	269	191	993	Ref	1.10	34	0.22	1.4	0.16	7.1	0.2
05515500	1391	203	982	Non-ref	0.05	63	15.14	29.9	0.51	23.5	1.3
05516500	761	233	978	Non-ref	0.23	64	4.77	9.4	0.51	16.9	0.6
05517000	1127	207	976	Non-ref	0.13	64	9.75	19.8	0.49	30.6	0.6
05517530	3564	197	957	Non-ref	0.05	39	33.35	47.2	0.71	39.0	1.2
05524500	1163	190	960	Non-ref	0.17	63	9.27	39.9	0.23	25.4	1.6
05525000	1777	187	963	Non-ref	0.15	64	9.49	33.3	0.29	26.2	1.3
05526000	5416	182	954	Non-ref	0.17	64	28.10	78.8	0.36	92.7	0.9
05529000	932	191	904	Non-ref	0.16	64	7.04	20.5	0.34	33.2	0.6
05532000	46	188	920	Non-ref	0.53	62	0.22	1.3	0.17	5.5	0.2
05535000	34	198	890	Non-ref	0.45	62	0.22	0.7	0.32	4.0	0.2
05536290	539	175	939	Non-ref	0.36	64	2.75	10.9	0.25	25.7	0.4
05536340	33	189	941	Non-ref	0.51	63	0.12	0.6	0.19	3.5	0.2
05537500	54	194	937	Non-ref	0.53	62	0.22	1.1	0.21	5.7	0.2
05540130	319	192	930	Non-ref	0.32	25	2.58	6.4	0.41	18.3	0.3
05540195	29	201	930	Non-ref	0.86	25	0.14	0.8	0.17	4.1	0.2
05540275	26	197	929	Non-ref	0.41	26	0.22	1.1	0.19	4.8	0.2
05540500	839	172	929	Non-ref	0.25	63	7.76	16.8	0.46	43.3	0.4
05550500	91	218	917	Non-ref	0.34	62	0.41	1.6	0.25	6.4	0.2
05551200	134	215	925	Non-ref	0.37	53	0.90	2.4	0.37	11.1	0.2
05551700	182	187	923	Non-ref	0.24	52	0.95	3.1	0.31	9.3	0.3
05554500	1500	189	899	Non-ref	0.31	64	5.41	15.5	0.35	30.1	0.5
05559500	298	170	928	Non-ref	0.44	21	0.68	1.6	0.42	8.5	0.2
05567500	1987	185	942	Non-ref	0.29	64	5.92	10.0	0.59	23.9	0.4
05568000	2779	145	927	Non-ref	0.22	31	11.40	22.1	0.52	40.8	0.5
05570910	622	208	932	Non-ref	0.33	35	2.35	9.3	0.25	16.1	0.6
05578500	868	186	970	Non-ref	0.21	64	4.16	12.7	0.33	17.4	0.7
05580000	588	189	958	Non-ref	0.40	64	2.49	4.9	0.51	14.4	0.3
05591550	90	188	992	Ref	0.51	33	0.47	1.8	0.26	6.8	0.3
05592500	5025	138	977	Non-ref	0.21	64	39.67	86.8	0.46	35.9	2.4
05592800	394	142	966	Non-ref	0.86	43	0.83	2.3	0.37	8.0	0.3
05593900	144	175	973	Ref	0.93	50	0.18	0.7	0.26	4.0	0.2
05595200	334	114	990	Non-ref	0.84	44	1.01	3.9	0.26	8.8	0.4
05600000	83	103	1194	Non-ref	0.99	21	0.32	1.5	0.21	4.2	0.4
06038500	2344	1965	656	Non-ref	0.03	64	27.64	31.1	0.89	31.3	1.0
06043500	2137	1575	513	Ref	0.07	57	13.64	17.7	0.77	30.9	0.6
06061500	497	1240	308	Non-ref	0.09	45	1.11	2.1	0.52	7.6	0.3
06066500	44416	1056	317	Non-ref	0.04	64	125.83	160.9	0.78	106.8	1.5
06076690	2191	1341	338	Non-ref	0.08	18	3.78	6.2	0.61	16.4	0.4
06078500	668	1459	507	Ref	0.11	18	9.35	12.0	0.78	29.4	0.4
06099000	2696	1086	312	Non-ref	0.14	45	4.70	10.2	0.46	24.8	0.4
06109500	89041	764	334	n/a	0.05	64	220.53	274.9	0.80	167.2	1.6
06177000	213130	597	323	n/a	0.04	64	237.83	300.6	0.79	132.7	2.3
06183450	2505	610	332	n/a	0.25	35	0.23	0.7	0.32	4.8	0.2
06186500	2567	2355	559	Non-ref	0.02	59	30.21	46.2	0.65	71.0	0.7
06191000	523	1714	393	Ref	0.06	51	3.35	5.5	0.61	15.6	0.4
06289000	471	1326	393	Ref	0.07	64	2.01	5.2	0.39	14.7	0.4
06290000	287	1195	401	Non-ref	0.13	32	0.69	1.7	0.42	7.2	0.2
06290500	1109	1097	403	Non-ref	0.08	51	3.74	6.9	0.54	19.4	0.4
06295250	2069	914	370	Ref	0.10	31	0.36	1.1	0.32	4.9	0.2
06298000	534	1237	381	Non-ref	0.10	64	2.16	6.6	0.33	19.2	0.3
06311000	63	2493	496	Ref	0.16	64	0.68	1.8	0.38	6.8	0.3
06340500	5802	522	417	Non-ref	0.27	64	1.31	4.7	0.28	13.4	0.4
06356500	3380	738	407	Non-ref	0.37	54	0.49	1.5	0.32	6.2	0.2
06360500	12675	506	426	Ref	0.38	59	2.02	6.3	0.32	20.3	0.3
06407500	422	1184	484	Non-ref	0.11	27	0.35	1.0	0.33	5.7	0.2
06410500	761	1408	554	Non-ref	0.08	60	1.44	2.4	0.60	9.7	0.2
06428500	8412	944	409	Non-ref	0.20	64	2.32	3.8	0.61	12.0	0.3
06430770	168	1618	640	Non-ref	0.03	25	0.70	2.0	0.35	6.1	0.3
06437020	41	1448	652	Non-ref	0.17	25	0.12	0.4	0.28	3.1	0.1
06445685	3548	924	418	Non-ref	0.23	26	0.51	1.3	0.38	8.0	0.2
06446000	5594	870	411	Non-ref	0.26	64	0.84	2.6	0.33	7.4	0.3
06449500	2675	700	465	Non-ref	0.08	64	2.98	4.0	0.74	13.0	0.3
06468170	2745	444	458	Ref	0.18	44	3.34	8.1	0.41	14.9	0.5
06470878	14193	366	497	Non-ref	0.16	32	15.08	94.1	0.16	57.9	1.6
06473000	25136	379	490	Non-ref	0.05	63	26.09	72.9	0.36	42.6	1.7
06479000	5491	351	626	Non-ref	0.21	33	39.44	88.5	0.44	41.7	2.1
06479438	1360	526	555	Ref	0.28	41	0.76	1.8	0.43	8.4	0.2
06479525	2836	508	581	Non-ref	0.16	37	1.42	3.8	0.38	13.0	0.3
06481000	10168	444	612	Non-ref	0.13	64	24.19	67.6	0.36	51.7	1.3
06600500	2295	333	686	Non-ref	0.26	64	5.31	11.0	0.48	28.3	0.4
06607500	9132	311	741	Non-ref	0.20	63	40.07	60.3	0.66	46.0	1.3
06614800	4	3167	693	Ref	0.10	40	0.04	0.2	0.22	1.6	0.1
06625000	686	2124	335	Non-ref	0.09	64	3.75	9.1	0.41	22.1	0.4
06632400	163	2374	368	Ref	0.12	59	0.98	2.5	0.39	8.7	0.3
06634620	2510	2003	295	Non-ref	0.17	29	0.29	0.9	0.31	6.6	0.1
06692000	2435	890	476	Non-ref	0.04	41	4.40	6.6	0.67	14.5	0.5
06770200	148303	650	625	n/a	0.14	25	37.10	61.8	0.60	219.0	0.3
06772000	1559	578	658	Non-ref	0.59	38	0.23	0.7	0.35	4.0	0.2
06783500	1831	614	630	Ref	0.24	19	0.64	2.4	0.27	6.7	0.4
06792000	3160	499	668	Non-ref	0.17	45	6.28	12.0	0.52	32.0	0.4

STAID	DA (km^2)	Elev. (m)	Precip. (mm/y)	Flow Ref. Condition	RBI	RBI (yrs)	Channel capacity $\overline{Q_{50}}$ (m^3/s)	$\overline{A_{50}}$ (m^2)	$\overline{V_{50}}$ (m/s)	$\overline{W_{50}}$ (m)	$\overline{D_{50}}$ (m)
06793000	37089	469	686	Non-ref	0.39	63	5.97	13.8	0.43	47.4	0.3
06804000	707	338	782	Non-ref	0.54	52	1.25	3.0	0.41	9.1	0.3
06805500	221107	307	778	n/a	0.14	60	198.74	256.8	0.77	313.7	0.8
06807410	1577	331	814	Non-ref	0.30	54	8.54	16.2	0.53	31.2	0.5
06808500	3434	284	837	Non-ref	0.30	64	13.69	25.6	0.54	48.0	0.5
06811500	2051	271	842	Non-ref	0.62	64	2.89	8.1	0.36	21.8	0.4
06813000	1316	264	849	Non-ref	0.50	47	3.19	9.0	0.36	27.0	0.3
06817700	3937	260	875	Non-ref	0.37	31	10.60	24.8	0.43	47.9	0.5
06824500	12639	907	477	Non-ref	0.17	44	2.09	4.1	0.52	21.6	0.2
06834000	3367	836	515	Non-ref	0.10	63	0.85	1.9	0.44	8.9	0.2
06835000	3885	835	514	Non-ref	0.11	44	1.07	2.3	0.47	7.2	0.3
06844500	40352	601	576	Non-ref	0.15	62	4.51	10.3	0.44	32.6	0.3
06853500	58018	458	710	n/a	0.24	64	3.28	7.8	0.42	31.1	0.2
06864050	18324	509	642	Non-ref	0.46	61	0.98	2.4	0.41	11.3	0.2
06871000	2199	535	589	Non-ref	0.44	60	0.45	1.3	0.34	7.8	0.2
06872500	5996	454	624	Non-ref	0.42	62	0.99	2.8	0.36	11.3	0.2
06876700	995	380	715	Ref	0.41	54	0.37	2.4	0.16	6.4	0.4
06881000	7019	400	745	Non-ref	0.25	60	5.87	13.8	0.42	25.2	0.5
06881500	10101	372	779	Non-ref	0.25	19	9.19	20.8	0.44	43.0	0.5
06884025	7128	371	777	Non-ref	0.34	39	5.52	10.9	0.51	33.3	0.3
06884200	891	385	789	Non-ref	0.67	54	0.55	2.0	0.28	9.0	0.2
06885500	1062	337	835	Ref	0.80	60	0.88	3.2	0.27	9.2	0.3
06890100	1116	281	920	Non-ref	0.82	44	0.40	1.3	0.30	8.4	0.2
06901500	1424	211	1017	Non-ref	0.66	35	1.72	5.7	0.30	22.0	0.3
06903900	1422	258	913	Non-ref	0.19	51	0.59	2.6	0.23	11.9	0.2
06904010	1917	244	913	Non-ref	0.25	34	13.92	27.8	0.50	25.5	1.1
06905500	4843	193	1009	Non-ref	0.38	64	17.55	37.7	0.47	48.2	0.8
06906500	1292146	179	998	n/a	0.07	13	1348.92	1251.5	1.08	282.1	4.4
06917380	756	238	1061	Ref	0.85	36	0.60	1.8	0.34	8.9	0.2
06918070	14012	213	1054	Non-ref	0.23	20	80.56	158.1	0.51	52.5	3.0
06931500	17	241	1041	Non-ref	0.77	25	0.04	0.2	0.19	2.8	0.1
07013000	2023	208	1027	Non-ref	0.34	64	9.08	13.2	0.69	30.9	0.4
07040100	4584	82	1218	Non-ref	0.12	48	33.92	94.4	0.36	35.3	2.7
07040450	6138	66	1245	Non-ref	0.10	37	19.95	58.5	0.34	39.9	1.5
07052250	1197	316	1088	Non-ref	0.36	19	7.39	17.5	0.42	36.5	0.5
07052500	2556	281	1098	Non-ref	0.31	64	7.27	14.2	0.51	38.8	0.4
07060500	25848	96	1142	Non-ref	0.24	64	306.14	327.6	0.93	158.4	2.1
07060710	150	133	1188	Ref	0.64	48	0.32	1.6	0.20	9.4	0.2
07076750	58016	62	1285	n/a	0.04	12	599.53	844.5	0.71	145.5	5.8
07094500	6369	1743	327	Non-ref	0.07	34	19.42	18.2	1.06	33.9	0.5
07126300	4957	1460	326	Non-ref	0.52	47	0.95	3.4	0.28	9.1	0.4
07141900	3652	578	624	Non-ref	0.58	55	0.84	3.4	0.25	7.0	0.5
07143300	1886	496	703	Non-ref	0.50	53	0.30	1.3	0.24	5.2	0.2
07143665	1906	424	782	Non-ref	0.53	40	0.44	1.7	0.26	6.7	0.2
07144200	3437	404	797	Non-ref	0.45	64	1.73	4.1	0.43	16.5	0.2
07144550	105749	375	803	n/a	0.27	45	15.40	29.7	0.52	76.3	0.4
07147070	1103	375	858	Non-ref	0.72	52	1.06	4.3	0.25	14.1	0.3
07153000	1393	245	901	Non-ref	0.63	64	0.83	2.9	0.28	16.6	0.2
07175500	5014	179	989	Non-ref	0.31	64	14.21	14.7	0.97	25.4	0.6
07185095	116	232	1080	Non-ref	0.84	18	0.33	2.1	0.16	8.5	0.2
07186000	3015	254	1074	Non-ref	0.42	64	6.37	14.7	0.43	30.5	0.5
07195800	37	358	1153	Ref	0.31	52	0.19	0.7	0.27	4.6	0.2
07197000	808	214	1136	Ref	0.39	64	5.31	8.0	0.67	21.2	0.4
07215500	451	2141	417	Non-ref	0.17	64	0.50	1.8	0.28	7.1	0.3
07229200	65770	310	917	n/a	0.39	32	3.03	8.1	0.37	28.0	0.3
07237500	30777	558	609	Non-ref	0.22	64	1.88	4.4	0.42	14.4	0.3
07238000	32517	511	665	Non-ref	0.26	64	3.48	7.5	0.46	21.7	0.3
07239300	33729	443	729	Non-ref	0.20	30	1.54	4.4	0.35	15.3	0.3
07239500	34491	395	806	Non-ref	0.29	64	3.66	8.3	0.44	21.4	0.4
07239700	34851	380	834	Non-ref	0.34	14	9.73	19.8	0.49	33.0	0.6
07241520	35452	338	850	Non-ref	0.51	25	6.32	18.5	0.34	34.2	0.5
07251500	559	145	1166	Non-ref	0.45	26	1.75	5.7	0.31	18.0	0.3
07263000	544	112	1288	Non-ref	0.78	37	1.88	5.2	0.36	16.9	0.3
07264000	536	61	1258	Non-ref	0.16	59	2.84	11.4	0.25	11.8	1.0
07268000	1362	83	1438	Non-ref	0.75	64	5.38	17.1	0.32	32.9	0.5
07274000	679	81	1427	Non-ref	0.50	61	2.86	6.6	0.43	18.9	0.4
07301410	743	680	568	Ref	0.28	52	0.35	1.1	0.32	5.0	0.2
07301420	1132	636	585	Non-ref	0.17	27	0.50	1.3	0.38	5.7	0.2
07312200	1689	302	692	Non-ref	0.76	53	0.35	1.3	0.26	4.2	0.3
07312500	8133	282	732	Non-ref	0.34	64	2.32	8.1	0.29	20.7	0.4
07325000	5079	447	714	Non-ref	0.38	64	1.43	4.2	0.34	10.5	0.4
07325800	342	417	729	Non-ref	0.49	45	0.53	1.5	0.34	6.3	0.2
07337000	124320	75	1207	n/a	0.15	64	180.86	436.7	0.41	137.8	3.2
07340000	6889	91	1300	Non-ref	0.24	64	68.32	232.0	0.29	62.8	3.7
07362100	997	30	1285	Ref	0.34	52	3.44	19.3	0.18	16.8	1.1
07362500	622	61	1336	Ref	0.32	44	0.97	7.6	0.13	11.8	0.6
08013500	1950	12	1568	Non-ref	0.22	62	3.81	9.4	0.40	24.6	0.4
08017300	204	141	1027	Non-ref	1.24	54	0.06	0.9	0.07	3.4	0.3
08022040	9295	58	1205	Non-ref	0.12	64	30.21	82.6	0.37	48.0	1.7
08023400	208	64	1281	Ref	0.73	30	0.13	1.1	0.12	3.7	0.3
08025500	383	42	1356	Ref	0.58	55	0.87	4.3	0.20	8.9	0.5
08026000	19378	18	1383	Non-ref	0.18	58	29.54	108.7	0.27	75.1	1.4
08029500	332	41	1391	Ref	0.47	61	1.84	6.8	0.27	12.7	0.5
08033300	205	77	1130	Ref	0.76	27	0.13	0.6	0.21	4.0	0.2

STAID	DA (km^2)	Elev. (m)	Precip. (mm/y)	Flow Ref. Condition	RBI	RBI (yrs)	Channel capacity $\overline{Q_{50}}$ (m^3/s)	$\overline{A_{50}}$ (m^2)	$\overline{V_{50}}$ (m/s)	$\overline{W_{50}}$ (m)	$\overline{D_{50}}$ (m)
08034500	974	83	1098	Non-ref	0.27	41	1.83	9.2	0.20	17.2	0.5
08038000	1303	52	1226	Non-ref	0.23	33	5.17	27.9	0.19	20.9	1.3
08039100	231	58	1257	Non-ref	0.58	25	0.98	3.5	0.28	7.3	0.5
08057410	16260	112	922	Non-ref	0.25	53	21.51	39.0	0.55	31.8	1.2
08064100	2090	104	948	Non-ref	0.51	30	3.46	13.1	0.27	13.3	1.0
08065350	36029	43	1052	Non-ref	0.13	50	83.71	161.0	0.52	63.8	2.5
08066300	394	19	1311	Ref	0.33	48	1.64	4.9	0.34	10.8	0.5
08067650	1168	35	1165	Non-ref	0.30	16	0.12	0.7	0.17	4.7	0.1
08068000	2145	0	1186	Non-ref	0.38	64	1.64	5.3	0.31	15.2	0.3
08068090	2492	10	1221	Non-ref	0.39	29	1.84	5.4	0.34	24.1	0.2
08068740	339	0	1134	Non-ref	0.52	38	0.18	0.7	0.25	3.7	0.2
08070200	1005	13	1270	Ref	0.36	29	2.51	5.2	0.48	11.8	0.4
08070500	272	36	1225	Non-ref	0.58	64	0.88	3.0	0.29	8.9	0.3
08071280	565	12	1291	Non-ref	0.42	28	0.21	1.4	0.15	5.1	0.3
08084000	5695	467	638	Non-ref	0.60	64	0.44	1.5	0.29	12.3	0.1
08086290	725	361	694	Ref	1.27	51	0.04	0.2	0.20	2.6	0.1
08095200	2968	160	828	Non-ref	0.64	49	1.14	2.7	0.42	10.8	0.3
08104100	3421	145	845	Non-ref	0.21	39	0.62	2.8	0.22	13.5	0.2
08104500	13540	122	859	Non-ref	0.22	51	8.10	11.7	0.69	18.6	0.6
08108700	101137	58	972	n/a	0.24	20	68.77	161.1	0.43	67.8	2.4
08110100	505	67	995	Non-ref	0.83	51	0.21	0.9	0.25	4.6	0.2
08110430	252	111	985	Non-ref	0.80	35	0.07	0.3	0.21	2.5	0.1
08110500	2507	83	977	Non-ref	0.52	64	0.83	2.0	0.41	6.5	0.3
08111700	974	37	1036	Non-ref	0.71	42	0.63	1.8	0.35	8.8	0.2
08114000	116827	9	1121	n/a	0.16	64	114.40	274.3	0.42	71.8	3.8
08116650	117428	0	1222	n/a	0.15	41	104.51	169.7	0.62	61.0	2.8
08123850	38617	581	545	Non-ref	0.68	46	0.40	1.5	0.26	11.1	0.1
08164000	2116	4	1037	Ref	0.65	64	1.86	4.3	0.43	12.8	0.3
08164300	860	49	991	Ref	0.84	52	0.66	2.5	0.26	9.6	0.3
08164450	749	18	1043	Non-ref	0.57	36	1.13	2.9	0.40	13.8	0.2
08164500	2751	4	1053	Non-ref	0.50	30	2.95	7.4	0.40	18.0	0.4
08180800	2505	150	663	Non-ref	0.19	30	2.17	4.5	0.48	7.9	0.6
08188500	10155	28	886	Non-ref	0.25	64	10.86	22.2	0.49	22.3	1.0
08189200	227	5	940	Non-ref	0.41	42	0.21	0.8	0.26	3.1	0.3
08321500	448	2043	415	Ref	0.17	26	0.58	1.7	0.35	7.1	0.2
08329928	44574	1521	221	Non-ref	0.09	15	14.38	27.9	0.52	75.7	0.4
08340500	3600	1805	242	Ref	1.03	43	0.24	0.5	0.49	4.2	0.1
08396500	39627	1003	316	Non-ref	0.22	64	2.90	7.3	0.40	18.2	0.4
09034900	15	3179	681	Ref	0.10	48	0.22	0.6	0.34	3.3	0.2
09035500	42	2987	607	Non-ref	0.17	48	0.47	1.0	0.48	4.1	0.2
09051050	48	2765	449	Non-ref	0.08	27	0.28	0.7	0.40	4.1	0.2
09057500	1546	2342	395	Non-ref	0.06	64	9.89	10.0	0.99	15.9	0.6
09058000	6162	2231	373	Non-ref	0.05	50	24.95	53.3	0.47	28.7	1.9
09059500	219	2217	362	Non-ref	0.10	64	1.20	3.3	0.37	11.7	0.3
09063000	182	2638	413	Non-ref	0.07	64	0.69	2.0	0.34	6.2	0.3
09064000	92	2804	443	Non-ref	0.15	45	0.86	2.8	0.30	10.8	0.3
09065100	88	2436	370	Non-ref	0.14	50	1.20	2.5	0.48	9.1	0.3
09081600	433	2105	393	Ref	0.09	58	4.19	9.3	0.45	24.3	0.4
09089500	167	2149	418	Non-ref	0.11	43	0.62	1.4	0.46	6.8	0.2
09107000	332	2847	454	Ref	0.08	26	2.91	5.4	0.54	15.9	0.3
09112500	749	2440	375	Non-ref	0.08	63	6.05	6.9	0.87	19.1	0.4
09114500	2618	2333	311	Non-ref	0.06	64	19.13	19.4	0.99	46.2	0.4
09132500	1360	1914	360	Non-ref	0.09	64	8.18	12.6	0.65	30.6	0.4
09152500	20520	1411	228	Non-ref	0.07	64	60.09	82.2	0.73	54.2	1.5
09165000	275	2567	652	Non-ref	0.11	59	2.88	4.0	0.71	13.2	0.3
09196500	196	2271	318	Ref	0.11	55	3.92	7.1	0.55	17.2	0.4
09210500	394	2118	263	Ref	0.08	62	1.33	2.7	0.50	9.6	0.3
09211200	11085	1944	193	Non-ref	0.04	50	30.99	49.7	0.62	72.0	0.7
09217000	36260	1847	204	Non-ref	0.05	62	34.20	43.8	0.78	73.1	0.6
09220000	137	2582	384	Non-ref	0.10	33	1.17	3.3	0.36	9.9	0.3
09261700	200	1715	242	Non-ref	0.06	34	0.74	1.8	0.41	7.7	0.2
09288000	363	2033	386	Non-ref	0.06	61	1.10	2.2	0.49	7.2	0.3
09288180	2375	1744	261	Non-ref	0.05	45	3.12	5.0	0.62	13.1	0.4
09291000	290	2429	399	Non-ref	0.09	64	7.89	7.6	1.04	16.5	0.5
09304200	1678	1951	417	Non-ref	0.07	52	9.69	14.2	0.68	25.3	0.6
09337500	829	1728	236	Non-ref	0.33	47	0.10	0.3	0.36	3.0	0.1
09363500	2823	1817	352	Non-ref	0.09	64	14.82	21.3	0.70	41.0	0.5
09372000	894	1490	259	Non-ref	0.21	62	1.44	2.5	0.58	7.4	0.3
09378630	10	2195	395	Ref	0.21	48	0.04	0.1	0.35	1.0	0.1
09394500	20906	1564	247	Non-ref	0.75	64	0.17	0.9	0.20	4.8	0.2
09408400	48	2024	432	Non-ref	0.10	54	0.14	0.7	0.21	4.1	0.2
09494000	1637	1331	438	Ref	0.15	56	2.01	5.7	0.35	15.1	0.4
10016900	1147	2051	292	Non-ref	0.13	12	3.93	5.5	0.71	16.8	0.3
10038000	6338	1871	307	Non-ref	0.05	57	6.83	11.4	0.60	26.4	0.4
10126000	18205	1282	436	Non-ref	0.12	57	35.00	89.3	0.39	59.4	1.5
10130500	1127	1707	421	Non-ref	0.07	64	5.23	6.7	0.78	16.2	0.4
10137500	355	1582	545	Non-ref	0.07	64	2.13	3.9	0.55	11.5	0.3
10163000	1743	1375	432	Non-ref	0.08	64	2.95	5.3	0.56	15.3	0.3
10172700	65	1890	400	Ref	0.04	55	0.10	0.3	0.35	1.7	0.2
10234500	236	1890	346	Ref	0.07	64	0.87	1.6	0.54	7.4	0.2
10244950	29	2268	348	Ref	0.02	47	0.13	0.2	0.56	1.4	0.2
10249300	52	1951	214	Ref	0.07	48	0.08	0.3	0.27	1.9	0.1
10265150	177	2118	372	Non-ref	0.03	30	1.30	1.7	0.74	4.7	0.4
10289500	51	2097	374	Non-ref	0.08	30	0.59	1.2	0.50	5.1	0.2

STAID	DA (km^2)	Elev. (m)	Precip. (mm/y)	Flow Ref. Condition	RBI	RBI (yrs)	Channel capacity $\overline{Q_{50}}$ (m^3/s)	$\overline{A_{50}}$ (m^2)	$\overline{V_{50}}$ (m/s)	$\overline{W_{50}}$ (m)	$\overline{D_{50}}$ (m)
10290500	101	2149	451	Non-ref	0.05	38	1.24	2.8	0.45	10.5	0.3
10310400	10	1554	411	Non-ref	0.08	42	0.04	0.1	0.33	1.3	0.1
10311090	5	1676	360	Non-ref	0.39	20	0.01	0.1	0.11	0.8	0.1
10311400	2481	1402	227	Non-ref	0.12	28	4.65	11.8	0.39	24.1	0.5
10324500	2237	1423	226	Non-ref	0.18	64	0.17	0.7	0.25	4.2	0.2
10325500	137	2164	231	Non-ref	0.08	28	0.13	0.4	0.33	2.9	0.1
10336698	16	1900	520	Non-ref	0.09	39	0.14	0.5	0.26	3.0	0.2
10336700	17	1904	519	Non-ref	0.06	30	0.14	0.4	0.34	2.3	0.2
10344500	448	1676	575	Non-ref	0.10	64	3.47	6.7	0.51	15.2	0.4
10347460	2681	1430	295	Non-ref	0.06	18	12.50	35.5	0.35	32.7	1.1
10353750	34	1853	300	Ref	0.05	20	0.05	0.2	0.24	1.8	0.1
11119500	34	40	428	Non-ref	1.12	62	0.08	0.4	0.19	2.3	0.2
11160020	16	216	831	Ref	0.32	24	0.05	0.3	0.19	2.1	0.1
11160500	275	69	756	Non-ref	0.40	64	1.04	4.8	0.22	16.0	0.3
11169000	378	22	389	Non-ref	0.77	53	0.41	1.4	0.29	6.8	0.2
11169500	24	161	660	Non-ref	0.49	64	0.04	0.2	0.18	1.8	0.1
11169800	282	241	507	Ref	0.59	30	0.19	1.1	0.17	6.7	0.2
11242400	44	1591	1023	Non-ref	0.18	41	0.28	1.1	0.26	5.1	0.2
11303000	2784	0	305	Non-ref	0.09	64	12.21	25.2	0.48	27.0	0.9
11348500	3706	1300	393	Non-ref	0.18	64	2.76	8.2	0.34	23.5	0.3
11355010	9741	859	626	Non-ref	0.07	38	46.29	70.2	0.66	32.6	2.2
11371000	298	403	1328	Ref	0.22	42	17.94	13.1	1.38	19.5	0.7
11377100	23051	88	657	Non-ref	0.09	64	292.51	202.1	1.45	113.2	1.8
11390500	33450	11	461	Non-ref	0.05	63	210.04	262.2	0.80	73.2	3.6
11425500	55040	-1	474	n/a	0.05	64	419.49	571.1	0.74	161.3	3.5
11449500	95	450	941	Ref	0.51	62	0.49	1.5	0.33	5.8	0.3
11460750	81	75	984	Non-ref	0.42	30	0.20	1.4	0.14	7.0	0.2
11468500	275	4	1069	Ref	0.38	62	0.92	3.1	0.30	12.7	0.2
11510700	10567	998	485	Non-ref	0.09	55	47.57	54.0	0.88	42.7	1.3
11519500	1691	800	657	Non-ref	0.17	64	13.20	21.3	0.62	32.4	0.7
11521500	311	365	1244	Non-ref	0.21	55	11.16	11.9	0.94	21.1	0.6
11527000	3727	288	1145	Non-ref	0.14	57	34.10	51.3	0.66	39.5	1.3
11530000	7389	84	1288	Non-ref	0.16	64	84.45	74.4	1.14	43.8	1.7
12026150	171	97	1221	Non-ref	0.16	42	4.33	7.2	0.60	17.1	0.4
12027500	2318	38	1288	Non-ref	0.21	64	55.13	214.8	0.26	73.2	2.9
12037400	401	12	2208	Non-ref	0.24	55	22.28	29.5	0.76	39.3	0.7
12045500	697	61	1414	Non-ref	0.18	64	33.01	64.1	0.51	26.9	2.4
12054000	172	74	1436	Ref	0.23	63	7.38	11.4	0.65	19.9	0.6
12079000	233	106	1184	Ref	0.27	50	2.86	10.0	0.29	20.9	0.5
12097500	190	526	1783	Ref	0.12	47	3.94	6.7	0.59	15.9	0.4
12101500	2455	5	1002	Non-ref	0.16	64	84.60	94.6	0.90	64.8	1.5
12112600	173	24	1093	Non-ref	0.11	53	2.52	3.6	0.70	10.9	0.3
12114500	66	573	2058	Ref	0.18	52	3.20	7.3	0.44	14.9	0.5
12116500	218	275	2177	Non-ref	0.16	64	4.47	11.5	0.39	26.0	0.4
12141300	399	238	2009	Ref	0.29	50	20.93	42.1	0.50	37.1	1.1
12143700	4	372	2218	Non-ref	0.03	64	0.42	1.0	0.44	5.6	0.2
12143900	9	198	1953	Non-ref	0.04	32	0.94	1.7	0.56	6.7	0.2
12147600	14	564	2201	Ref	0.45	50	0.85	2.6	0.32	7.5	0.3
12148300	77	204	1841	Non-ref	0.13	31	2.42	6.1	0.40	10.3	0.6
12155300	329	9	1127	Non-ref	0.27	21	10.93	15.0	0.73	23.2	0.6
12301300	1140	768	446	Non-ref	0.08	55	4.83	8.0	0.61	21.5	0.4
12304500	1984	561	675	n/a	0.10	57	11.23	20.7	0.54	37.3	0.6
12324200	2577	1372	285	Non-ref	0.06	35	6.36	11.3	0.56	24.8	0.5
12330000	185	1448	339	Non-ref	0.10	62	0.78	2.4	0.32	8.1	0.3
12331500	1269	1224	294	Non-ref	0.09	19	3.31	6.1	0.55	14.9	0.4
12335500	300	1414	389	Non-ref	0.16	62	0.83	2.3	0.36	8.8	0.3
12340500	15537	975	362	Non-ref	0.06	64	62.65	84.2	0.74	70.6	1.2
12346500	227	1339	397	Non-ref	0.06	26	1.33	3.1	0.43	10.4	0.3
12353000	23318	940	347	Non-ref	0.06	64	101.78	171.8	0.59	112.9	1.5
12354500	27736	793	526	Non-ref	0.06	64	120.42	152.4	0.79	101.7	1.5
12358500	2922	954	690	Ref	0.09	64	49.91	52.6	0.95	69.0	0.8
12359800	3004	1090	666	Ref	0.11	17	39.03	53.0	0.74	62.3	0.9
12370000	1738	933	608	Non-ref	0.05	64	23.04	42.1	0.55	73.2	0.6
12372000	18379	821	421	Non-ref	0.08	64	326.28	315.0	1.04	80.3	3.9
12375900	20	1012	487	Ref	0.10	31	0.30	1.3	0.23	6.0	0.2
12388400	61	1042	438	Ref	0.09	27	0.31	1.1	0.28	4.9	0.2
12390700	471	726	624	Ref	0.08	57	2.02	4.5	0.45	13.4	0.3
12397100	133	774	723	Non-ref	0.07	55	0.69	1.7	0.41	8.5	0.2
12442500	9194	347	292	n/a	0.08	64	27.58	53.0	0.52	64.2	0.8
12445000	18803	262	303	n/a	0.06	60	44.81	87.7	0.51	49.5	1.8
12458000	500	442	721	Ref	0.12	41	8.97	21.9	0.41	23.4	0.9
12459000	2590	313	565	Non-ref	0.09	64	56.42	98.3	0.57	68.7	1.4
12462500	3370	207	331	Non-ref	0.09	51	52.23	57.7	0.91	54.0	1.1
12484500	4128	396	221	Non-ref	0.07	64	67.60	75.0	0.90	60.8	1.2
12488500	204	823	1224	Ref	0.11	64	4.39	6.3	0.70	14.5	0.4
12508990	13880	197	186	Non-ref	0.08	41	60.48	208.6	0.29	111.4	1.9
13011000	2090	2056	598	Non-ref	0.05	64	16.85	39.6	0.43	55.6	0.7
13018750	6804	1858	432	Non-ref	0.04	38	69.77	73.8	0.95	58.6	1.3
13022500	8974	1772	452	Non-ref	0.04	60	101.49	88.5	1.15	70.6	1.3
13027500	2220	1730	445	Non-ref	0.03	60	16.25	21.8	0.74	44.1	0.5
13032500	13533	1632	455	Non-ref	0.03	64	110.98	90.7	1.22	94.5	1.0
13042500	1298	1897	643	Non-ref	0.04	64	15.91	20.8	0.76	37.5	0.6
13046680	225	1948	595	Ref	0.05	19	2.47	5.2	0.48	13.9	0.4
13047500	852	1704	505	Non-ref	0.07	64	12.95	17.1	0.76	41.2	0.4

STAID	DA (km^2)	Elev. (m)	Precip. (mm/y)	Flow Ref. Condition	RBI	RBI (yrs)	Channel capacity $\overline{Q_{50}}$ (m^3/s)	$\overline{A_{50}}$ (m^2)	$\overline{V_{50}}$ (m/s)	$\overline{W_{50}}$ (m)	$\overline{D_{50}}$ (m)
13050500	4584	1509	365	Non-ref	0.06	52	46.29	44.7	1.04	61.7	0.7
13052200	873	1814	452	Non-ref	0.06	52	9.50	21.1	0.45	54.4	0.4
13057155	24690	1442	277	Non-ref	0.04	26	163.12	295.8	0.56	122.2	2.4
13060000	25356	1402	272	Non-ref	0.05	64	147.64	145.6	1.01	147.8	1.0
13068500	3354	1347	272	Non-ref	0.12	62	3.28	4.6	0.72	12.7	0.4
13069500	29293	1341	270	Non-ref	0.07	64	79.31	119.7	0.66	84.6	1.4
13075500	3253	1347	311	Non-ref	0.05	64	6.56	8.7	0.75	14.7	0.6
13077000	35224	1293	289	Non-ref	0.04	64	249.76	209.7	1.19	211.7	1.0
13081500	40663	1259	258	Non-ref	0.04	64	211.08	315.5	0.67	145.9	2.2
13118700	1129	1792	243	Non-ref	0.06	56	1.33	1.9	0.70	7.1	0.3
13120000	298	2079	350	Non-ref	0.09	64	1.15	3.1	0.37	10.0	0.3
13153500	7770	840	227	Non-ref	0.13	28	3.20	12.1	0.27	18.4	0.7
13176000	1186	1654	317	Non-ref	0.10	34	2.80	4.7	0.59	9.9	0.5
13200000	1028	951	467	Non-ref	0.09	63	3.81	7.1	0.54	17.2	0.4
13246000	2385	939	556	Non-ref	0.06	64	24.07	41.1	0.59	42.8	1.0
13247500	5750	800	454	Non-ref	0.06	64	67.19	86.4	0.78	68.7	1.3
13249500	7071	732	374	Non-ref	0.08	64	43.33	66.1	0.66	80.6	0.8
13296500	2090	1798	406	Ref	0.06	48	14.13	23.2	0.61	25.1	0.9
13297355	185	1740	326	Non-ref	0.08	41	0.40	1.2	0.34	6.2	0.2
13317000	34760	431	479	Non-ref	0.06	64	152.50	162.2	0.94	89.9	1.8
13330000	184	1113	433	Non-ref	0.11	57	1.80	4.3	0.42	12.5	0.3
13334300	240765	246	378	n/a	0.06	55	671.91	475.6	1.41	151.7	3.1
13336500	4960	469	660	Non-ref	0.10	64	52.10	75.9	0.69	81.2	0.9
13337000	3051	443	685	Ref	0.10	64	39.52	80.0	0.49	66.3	1.2
13340000	14263	302	638	Ref	0.10	49	128.34	187.9	0.68	98.0	1.9
13340600	3357	506	763	Ref	0.09	46	57.52	93.8	0.61	68.9	1.4
14103000	27195	51	269	Non-ref	0.03	64	141.45	157.3	0.90	133.2	1.2
14140000	277	173	1991	Non-ref	0.36	64	3.32	12.9	0.26	21.4	0.6
14154500	546	261	1288	Ref	0.32	64	6.18	18.6	0.33	35.6	0.5
14158850	477	604	1774	Non-ref	0.05	54	25.66	24.9	1.03	33.0	0.8
14165000	458	135	1249	Non-ref	0.21	50	6.69	8.7	0.77	16.2	0.5
14185000	451	236	1701	Ref	0.26	64	12.31	22.4	0.55	37.3	0.6
14185900	257	320	2057	Ref	0.33	48	10.79	19.5	0.55	31.3	0.6
14187200	1443	162	1365	Non-ref	0.13	40	43.66	58.3	0.75	83.0	0.7
14194300	23	171	1872	Ref	0.21	30	1.19	2.3	0.51	8.0	0.3
14208700	141	927	1892	Non-ref	0.10	57	3.16	6.1	0.52	15.0	0.4
14211500	69	70	1305	Non-ref	0.41	64	0.39	1.8	0.21	6.5	0.3
14220500	1893	13	1827	Non-ref	0.15	64	82.75	125.0	0.66	71.1	1.8
14236200	365	183	1525	Ref	0.24	57	13.60	20.1	0.68	32.7	0.6
14306500	865	15	2248	Ref	0.24	64	19.76	23.5	0.84	31.9	0.7
14308990	168	579	968	Ref	0.27	28	0.97	5.3	0.18	14.1	0.4
14316500	1230	482	1241	Non-ref	0.09	64	32.61	38.6	0.84	32.7	1.2
14330000	982	599	987	Non-ref	0.06	45	37.63	40.6	0.93	31.3	1.3
14334700	637	619	989	Non-ref	0.13	23	6.96	15.7	0.44	20.8	0.8
14337600	2429	454	762	Non-ref	0.06	48	52.79	72.1	0.73	46.5	1.6
14337800	204	553	954	Ref	0.28	26	1.39	4.1	0.34	17.1	0.2
14359000	5317	342	585	Non-ref	0.12	64	61.72	101.5	0.61	57.0	1.8
15041200	17094	15	1729	n/a	0.10	26	703.02	558.7	1.25	201.9	2.8
15294005	430	107	484	Ref	0.12	26	14.87	15.8	0.94	30.4	0.5
15348000	15229	366	258	n/a	0.20	14	145.40	141.8	1.03	75.6	1.9
15356000	293964	259	291	n/a	0.03	62	4528.83	2482.4	1.82	498.6	5.0
15470000	8495	513	254	n/a	0.04	21	115.98	136.8	0.85	58.2	2.4

STAID	$\hat{w}$ (%/dec)	$\hat{w}$ SE (%/dec)	$\hat{w}$ p	$\hat{h}$ (%/dec)	$\hat{h}$ SE (%/dec)	$\hat{h}$ p	$\hat{U}$ (%/dec)	$\hat{U}$ SE (%/dec)	$\hat{U}$ p	$\hat{Q}$ (%/dec)	$\hat{Q}$ SE (%/dec)	$\hat{Q}$ p	N msts	N years
01034000	0.16	0.53	7.68E-01	2.80	1.03	1.03E-02	-4.49	1.08	1.93E-04	-2.34	1.12	4.46E-02	36	22.4
01047000	-2.81	1.64	9.63E-02	1.35	2.28	5.59E-01	4.17	3.16	1.97E-01	2.96	1.18	1.74E-02	34	20.4
01048000	-0.43	0.57	4.58E-01	0.87	1.44	5.49E-01	2.78	1.28	3.72E-02	3.02	0.63	2.91E-05	38	20.8
01059000	0.45	0.44	3.16E-01	-2.15	0.50	1.35E-04	0.34	0.81	6.77E-01	-1.23	0.50	1.93E-02	33	21.8
01089100	2.76	0.85	1.75E-03	10.04	2.00	2.97E-06	2.24	2.28	3.29E-01	17.22	1.48	1.00E-06	85	25.7
01094400	-5.82	3.03	5.78E-02	12.25	2.24	<1.00E-06	-6.36	3.30	5.66E-02	13.11	3.16	7.36E-05	92	26.2
01097000	0.06	0.94	9.53E-01	8.44	1.98	4.40E-05	-5.48	2.54	3.34E-02	0.62	1.29	6.31E-01	101	27.3
01099500	4.71	0.61	<1.00E-06	0.81	0.72	2.60E-01	-6.34	1.07	<1.00E-06	-1.24	0.84	1.48E-01	60	24.7
01100000	2.46	0.45	1.35E-06	0.26	0.51	6.06E-01	-3.06	0.82	4.42E-04	-0.98	0.72	1.82E-01	53	24.9
01101000	1.11	0.50	2.89E-02	0.54	1.03	6.05E-01	-4.56	1.92	2.05E-02	0.23	1.03	8.28E-01	68	26.5
01102500	-1.23	1.01	2.30E-01	11.01	4.26	1.18E-02	-2.35	4.42	5.97E-01	-0.22	0.76	7.72E-01	75	25.7
01105585	0.54	3.84	8.90E-01	0.06	2.31	9.79E-01	8.05	3.65	3.28E-02	4.48	3.94	2.62E-01	42	23.7
01105933	0.12	0.40	7.63E-01	-6.98	1.30	<1.00E-06	3.82	2.15	8.00E-02	-2.44	2.23	2.76E-01	71	21.9
01109000	2.74	1.05	1.10E-02	1.10	1.21	3.69E-01	-2.72	2.07	1.93E-01	2.24	1.05	3.53E-02	83	28.0
01114500	0.18	1.12	8.74E-01	-8.14	1.57	<1.00E-06	-2.51	3.79	5.09E-01	-4.68	3.75	2.15E-01	109	24.3
01116000	-1.26	0.54	2.11E-02	-0.27	0.69	6.89E-01	8.29	1.08	<1.00E-06	6.07	1.56	1.93E-04	91	24.0
01117000	-2.29	0.48	6.57E-06	-0.81	1.25	5.20E-01	3.76	1.46	1.17E-02	0.13	1.05	9.04E-01	95	27.2
01117468	-0.95	0.41	2.25E-02	1.72	0.56	2.66E-03	-17.71	1.05	<1.00E-06	-16.93	1.07	1.00E-06	96	23.0
01118300	3.98	0.77	<1.00E-06	2.76	0.72	1.66E-04	-17.84	1.26	<1.00E-06	-11.12	0.74	1.00E-06	206	49.9
01123360	1.37	1.32	3.02E-01	10.52	2.41	5.00E-05	11.70	2.34	4.98E-06	22.68	1.82	1.00E-06	63	26.5
01127000	-2.28	1.13	4.96E-02	1.15	2.12	5.91E-01	-3.40	3.19	2.93E-01	-3.46	1.40	1.73E-02	44	22.3
01127500	-5.47	1.40	2.01E-04	8.54	1.63	1.30E-06	3.68	1.67	3.09E-02	7.59	1.18	1.00E-06	79	22.8
01129200	-0.85	0.76	2.70E-01	0.66	1.19	5.81E-01	1.57	1.30	2.35E-01	0.80	1.03	4.46E-01	42	23.9

STAID	$\hat{w}$ (%/dec)	$\hat{w}$ SE (%/dec)	$\hat{w}$ p	$\hat{h}$ (%/dec)	$\hat{h}$ SE (%/dec)	$\hat{h}$ p	$\hat{U}$ (%/dec)	$\hat{U}$ SE (%/dec)	$\hat{U}$ p	$\hat{Q}$ (%/dec)	$\hat{Q}$ SE (%/dec)	$\hat{Q}$ p	N msts	N years
01135150	7.64	3.98	6.03E-02	-7.50	3.27	2.57E-02	2.65	5.03	6.00E-01	2.89	1.21	1.99E-02	54	22.5
01138500	-0.13	0.29	6.46E-01	-2.30	1.18	5.58E-02	6.75	1.32	3.40E-06	3.05	1.13	9.22E-03	60	24.6
01169000	5.66	1.83	2.85E-03	-1.97	1.72	2.56E-01	8.10	2.26	6.05E-04	12.01	1.06	1.00E-06	75	25.4
01175670	5.27	2.39	2.99E-02	-2.77	2.45	2.62E-01	2.80	5.28	5.97E-01	-7.00	4.27	1.05E-01	92	23.5
01177000	-0.72	0.91	4.35E-01	1.39	1.09	2.13E-01	-3.34	1.67	5.46E-02	-0.87	1.59	5.90E-01	32	26.9
01183500	-5.80	0.93	<1.00E-06	-1.27	2.97	6.72E-01	0.96	3.28	7.70E-01	-2.03	1.53	1.94E-01	37	25.0
01196500	-9.82	1.80	<1.00E-06	-1.40	1.84	4.50E-01	-20.92	2.44	<1.00E-06	-33.10	2.20	1.00E-06	84	33.6
01200000	1.20	0.46	1.15E-02	2.48	0.53	1.76E-05	-2.94	0.79	4.41E-04	1.42	0.65	3.29E-02	64	28.1
01204000	-0.88	0.95	3.61E-01	3.04	0.82	3.34E-04	2.66	1.74	1.29E-01	6.41	0.75	1.00E-06	99	25.4
01206900	0.51	0.73	4.91E-01	-20.27	3.20	<1.00E-06	27.14	3.65	<1.00E-06	1.81	0.82	3.00E-02	67	22.9
01208925	-5.30	1.54	9.28E-04	1.18	1.35	3.83E-01	11.04	1.51	<1.00E-06	6.41	1.55	3.79E-05	76	23.2
01208990	-5.58	2.51	2.97E-02	10.94	2.03	<1.00E-06	9.02	2.20	1.11E-04	14.00	1.04	1.00E-06	70	22.6
01209700	5.18	1.75	4.10E-03	5.96	1.98	3.51E-03	-1.91	2.16	3.81E-01	3.43	1.42	1.83E-02	78	27.2
01315000	-0.79	0.31	1.32E-02	0.42	0.20	4.17E-02	-1.60	0.29	<1.00E-06	-2.20	0.21	1.00E-06	100	60.7
01318500	0.15	0.29	6.08E-01	0.73	0.26	6.14E-03	-0.46	0.17	9.47E-03	0.15	0.15	3.23E-01	75	55.0
01321000	0.36	0.25	1.58E-01	-0.56	0.52	2.82E-01	3.68	0.56	<1.00E-06	2.93	0.48	1.00E-06	74	57.3
01332500	-0.44	1.13	7.01E-01	12.23	1.58	<1.00E-06	-8.34	2.12	2.01E-04	0.87	1.17	4.59E-01	70	23.9
01334000	4.14	1.23	1.32E-03	7.19	1.27	<1.00E-06	1.99	1.39	1.56E-01	10.13	1.21	1.00E-06	67	26.0
01336000	0.91	0.08	<1.00E-06	-0.42	0.18	1.99E-02	0.26	0.21	2.15E-01	0.62	0.14	2.77E-05	142	62.3
01350080	10.05	3.00	1.24E-03	3.00	3.98	4.54E-01	42.63	5.60	<1.00E-06	60.31	3.65	1.00E-06	82	27.0
01350120	1.73	3.59	6.32E-01	8.90	3.89	2.53E-02	7.31	8.28	3.81E-01	17.97	5.76	2.65E-03	70	21.2
01364959	5.42	1.59	9.97E-04	5.43	2.07	1.04E-02	-8.49	3.47	1.66E-02	7.07	1.67	6.36E-05	81	21.6
01401650	-2.18	2.68	4.18E-01	-9.52	2.76	7.87E-04	-12.00	3.04	1.36E-04	-28.57	3.84	1.00E-06	113	27.5
01403500	19.44	4.90	1.77E-04	23.39	3.85	<1.00E-06	9.17	5.72	1.13E-01	57.96	3.34	1.00E-06	69	23.6
01403535	4.18	4.95	4.00E-01	-17.09	4.60	3.68E-04	-4.09	5.88	4.89E-01	-16.45	4.31	2.55E-04	85	20.6
01409400	1.18	0.45	9.62E-03	1.07	0.82	1.97E-01	-0.34	0.68	6.14E-01	0.66	0.45	1.40E-01	136	41.1
01409500	4.40	0.79	<1.00E-06	10.06	1.91	<1.00E-06	-15.74	2.20	<1.00E-06	2.91	0.66	2.38E-05	107	34.6
01409810	3.27	1.17	6.18E-03	10.71	1.26	<1.00E-06	-0.04	1.51	9.81E-01	11.40	0.87	1.00E-06	104	36.5
01410150	8.18	0.96	<1.00E-06	4.10	0.98	5.83E-05	-4.62	1.20	1.88E-04	7.70	1.04	1.00E-06	122	33.0
01411456	1.90	0.73	1.07E-02	4.27	1.42	3.39E-03	-19.80	3.32	<1.00E-06	-12.88	3.16	9.21E-05	98	20.5
01413500	0.84	0.42	4.67E-02	-3.65	1.06	6.65E-04	-17.08	1.05	<1.00E-06	-25.65	2.13	1.00E-06	288	58.8
01429000	3.70	0.38	<1.00E-06	6.25	0.52	<1.00E-06	-0.17	0.73	8.12E-01	11.19	0.46	1.00E-06	270	62.9
01434000	0.12	0.04	2.52E-03	-0.20	0.10	4.69E-02	-2.39	0.17	<1.00E-06	-2.44	0.17	1.00E-06	265	60.8
01438500	0.22	0.11	5.39E-02	0.27	0.12	1.89E-02	-0.59	0.37	1.14E-01	0.10	0.32	7.63E-01	279	44.2
01439500	0.39	0.30	1.95E-01	-1.73	0.54	1.61E-03	-1.06	0.59	7.32E-02	-3.24	0.51	1.00E-06	202	51.4
01440400	2.18	0.24	<1.00E-06	2.73	0.57	3.31E-06	1.45	0.62	2.03E-02	7.64	0.62	1.00E-06	218	55.8
01447500	2.08	0.41	<1.00E-06	2.53	0.45	<1.00E-06	2.89	0.82	4.80E-04	5.19	0.59	1.00E-06	241	57.8
01447800	-0.04	0.14	7.99E-01	-3.86	0.25	<1.00E-06	0.00	0.28	9.88E-01	-4.09	0.24	1.00E-06	198	50.8
01448500	-0.46	1.02	6.53E-01	14.17	1.04	<1.00E-06	-16.62	1.67	<1.00E-06	-1.42	0.43	1.01E-03	235	46.7
01449360	0.56	0.14	1.15E-04	-3.11	0.20	<1.00E-06	1.61	0.54	3.00E-03	-0.53	0.47	2.60E-01	200	47.1
01457500	-0.65	0.34	7.12E-02	0.39	0.26	1.51E-01	-1.08	0.50	4.36E-02	0.35	0.41	3.92E-01	23	46.1
01459500	-3.12	0.77	7.11E-05	1.32	0.89	1.40E-01	-3.35	1.38	1.59E-02	-3.61	0.83	2.17E-05	246	62.8
01465500	-3.49	1.08	1.51E-03	5.72	1.12	<1.00E-06	6.32	1.57	9.11E-05	5.92	0.64	1.00E-06	154	46.3
01468500	1.59	1.10	1.51E-01	8.26	1.88	2.19E-05	5.08	1.20	4.25E-05	14.30	1.45	1.00E-06	132	39.5
01470779	0.02	0.96	9.87E-01	10.67	1.40	<1.00E-06	6.01	1.49	9.59E-05	16.90	0.93	1.00E-06	123	37.2
01470960	-0.49	0.32	1.30E-01	0.35	0.58	5.44E-01	0.06	1.08	9.56E-01	-0.69	1.02	4.97E-01	127	37.5
01471980	5.03	0.73	<1.00E-06	-0.42	1.15	7.18E-01	2.63	1.82	1.51E-01	6.99	1.59	2.41E-05	123	32.8
01472157	2.18	0.25	<1.00E-06	-1.95	0.66	3.42E-03	-1.66	0.81	4.32E-02	-1.41	0.61	2.19E-02	157	44.6
01473000	0.57	0.22	1.08E-02	2.80	0.70	1.07E-04	1.58	0.79	4.69E-02	4.73	0.34	1.00E-06	168	59.6
01475300	25.67	3.63	<1.00E-06	-12.17	3.54	8.98E-04	6.76	4.89	1.70E-01	23.18	2.39	1.00E-06	91	20.5
01477120	-2.79	0.38	<1.00E-06	-6.73	1.66	7.45E-05	-13.95	1.10	<1.00E-06	-22.04	1.64	1.00E-06	165	38.6
01479000	5.75	2.10	6.80E-03	20.66	1.77	<1.00E-06	-0.21	1.95	9.15E-01	25.51	1.53	1.00E-06	176	34.3
01480700	5.37	0.41	<1.00E-06	4.85	0.83	<1.00E-06	3.89	1.07	3.65E-04	13.18	0.85	1.00E-06	186	47.8
01486000	-3.94	3.44	2.54E-01	-22.77	2.87	<1.00E-06	30.55	3.56	<1.00E-06	6.37	0.85	1.00E-06	154	27.7
01488500	2.16	0.98	2.87E-02	-5.53	0.97	<1.00E-06	-8.95	2.13	5.10E-05	-11.63	1.68	1.00E-06	117	24.4
01489000	-3.01	1.13	8.32E-03	-12.82	1.12	<1.00E-06	20.41	1.56	<1.00E-06	5.19	0.44	1.00E-06	214	50.0
01490000	7.44	0.49	<1.00E-06	5.62	0.61	<1.00E-06	-7.57	1.62	6.09E-06	10.34	1.08	1.00E-06	187	56.0
01496000	0.87	0.60	1.52E-01	-1.84	0.87	3.66E-02	-1.95	1.08	7.11E-02	-2.30	0.74	2.22E-03	180	48.6
01496200	-5.15	0.97	<1.00E-06	2.04	2.08	3.29E-01	6.41	2.64	1.65E-02	3.19	1.40	2.40E-02	128	24.5
01513500	-1.27	0.21	<1.00E-06	-1.77	0.34	<1.00E-06	3.40	0.49	<1.00E-06	0.12	0.41	7.63E-01	110	41.2
01518700	-3.59	1.54	2.12E-02	-8.19	1.97	6.48E-05	5.73	2.27	1.27E-02	-4.19	0.50	1.00E-06	116	34.2
01527000	-4.20	4.27	3.47E-01	2.10	2.72	4.56E-01	-12.19	3.81	8.53E-03	-10.35	5.51	3.69E-02	12	25.8
01533400	1.62	0.67	1.83E-02	-1.13	0.74	1.27E-01	-0.48	0.60	4.26E-01	-0.18	0.58	7.55E-01	84	30.3
01534300	2.83	0.56	<1.00E-06	1.22	0.52	2.09E-02	-6.85	0.71	<1.00E-06	-2.80	0.41	1.00E-06	189	53.6
01541303	-3.87	0.48	<1.00E-06	-0.10	0.73	8.93E-01	-0.04	0.85	9.65E-01	-4.10	0.88	3.88E-06	121	34.1
01548005	0.03	0.91	9.71E-01	1.34	2.03	5.13E-01	6.26	1.49	7.03E-05	6.85	0.71	1.00E-06	80	23.6
01549500	2.77	0.79	4.89E-04	8.28	0.60	<1.00E-06	11.58	0.95	<1.00E-06	28.83	1.35	1.00E-06	263	61.8
01555500	6.58	0.51	<1.00E-06	-1.76	0.59	3.45E-03	-1.06	1.21	3.83E-01	4.41	0.84	1.00E-06	99	35.5
01560000	2.66	0.38	<1.00E-06	-0.33	0.48	4.90E-01	-9.60	0.85	<1.00E-06	-8.42	0.87	1.00E-06	173	46.8
01563200	0.00	0.58	9.95E-01	0.36	0.98	7.15E-01	-0.77	0.81	3.42E-01	-0.67	0.27	1.24E-02	127	37.3
01567000	0.37	0.26	1.63E-01	0.55	0.63	3.82E-01	-1.30	0.72	7.20E-02	-0.56	0.44	2.09E-01	150	48.5
01567500	1.16	1.00	2.49E-01	1.56	1.14	1.74E-01	-23.66	1.53	<1.00E-06	-17.64	1.85	1.00E-06	173	44.5
01568000	1.02	0.28	3.64E-04	2.49	0.67	2.61E-04	1.53	0.82	6.27E-02	4.32	0.40	1.00E-06	159	48.2
01569800	2.29	1.77	1.98E-01	0.61	2.38	8.00E-01	-5.76	2.54	2.58E-02	-1.34	1.02	1.92E-01	88	20.8
01570000	-0.96	0.32	3.38E-03	-0.34	0.65	6.05E-01	0.30	0.63	6.32E-01	-1.41	0.35	3.98E-05	164	41.1
01581700	-1.28	1.41	3.63E-01	-12.20	1.27	<1.00E-06	-14.19	1.83	<1.00E-06	-27.78	2.19	1.00E-06	218	40.9
01582500	-3.17	0.78	8.10E-05	1.58	1.62	3.30E-01	0.43	1.34	7.49E-01	-3.03	0.66	3.03E-06	147	36.2
01583500	1.37	0.65	3.55E-02	7.76	0.60	<1.00E-06	11.77	0.97	<1.00E-06	21.32	0.78	1.00E-06	298	57.9
01584050	-0.24	0.33	4.70E-01	0.20	0.45	6.52E-01	1.60	0.52	2.54E-03	0.62	0.37	9.60E-02	140	32.7
01584500	9.54	0.68	<1.00E-06	2.89	0.93	2.34E-03	-15.56	1.08	<1.00E-06	-2.37	0.26	1.00E-06	135	59.1
01585400	-10.09	2.89	6.44E-04	13.17	2.18	<1.00E-06	-5.95	3.31	7.43E-02	-3.90	1.73	2.55E-02	147	29.2
01590000	-4.52	1.41	1.71E-03	13.46	2.67	1.72E-06	5.14	2.63	5.29E-02	14.61	2.07	1.00E-06	115	25.8
01591400	1.62	0.85	5.93E-02	12.42	1.53	<1.00E-06	19.92	2.60	<1.00E-06	33.69	2.41	1.00E-06	100	23.8
01594000	-3.11	1.13	7.22E-03	-0.95	1.97	6.31E-01	-2.92	2.42	2.31E-01	-8.06	0.75	1.00E-06	97	23.3
01594526	5.49	0.62	<1.00E-06	-10.20	1.59	<1.00E-06	-1.75	1.75	3.18E-01	-6.96	0.75	1.00E-06	100	30.2

STAID	$\hat{w}$ (%/dec)	$\hat{w}$ SE (%/dec)	$\hat{w}$ p	$\hat{b}$ (%/dec)	$\hat{b}$ SE (%/dec)	$\hat{b}$ p	$\hat{U}$ (%/dec)	$\hat{U}$ SE (%/dec)	$\hat{U}$ p	$\hat{Q}$ (%/dec)	$\hat{Q}$ SE (%/dec)	$\hat{Q}$ p	N msts	N years
01594950	4.96	2.45	4.62E-02	0.51	3.28	8.76E-01	-12.81	3.26	1.60E-04	-12.07	1.78	1.00E-06	100	21.5
01595800	-0.28	0.27	3.04E-01	-1.11	0.84	1.90E-01	2.12	0.64	1.20E-03	0.39	0.45	3.91E-01	117	42.6
01610000	-0.85	0.35	1.48E-02	-0.19	0.29	5.10E-01	1.38	0.39	5.15E-04	-0.67	0.33	4.12E-02	149	58.4
01614500	3.72	0.24	<1.00E-06	-0.38	0.19	4.56E-02	-3.33	0.31	<1.00E-06	-0.17	0.17	3.20E-01	233	60.8
01616000	7.58	0.69	<1.00E-06	-7.81	1.14	<1.00E-06	15.42	1.34	<1.00E-06	17.65	0.85	1.00E-06	134	44.6
01617800	5.22	0.56	<1.00E-06	-0.63	0.47	1.89E-01	-3.62	0.88	6.21E-05	1.66	0.44	2.01E-04	185	44.6
01626000	-2.17	1.49	1.49E-01	-3.25	1.22	9.11E-03	0.43	2.21	8.45E-01	-9.19	0.84	1.00E-06	96	31.4
01627500	-3.70	0.96	1.88E-04	1.08	0.86	2.10E-01	9.49	1.25	<1.00E-06	9.02	1.69	1.00E-06	113	58.2
01628500	1.58	0.23	<1.00E-06	1.60	0.54	3.42E-03	-3.51	0.54	<1.00E-06	-0.68	0.28	1.59E-02	212	58.6
01632900	1.50	0.41	3.24E-04	8.08	0.73	<1.00E-06	4.67	0.94	1.48E-06	13.11	1.05	1.00E-06	176	45.5
01634500	-10.70	2.88	3.85E-04	-9.81	2.05	8.23E-06	-9.09	2.38	2.80E-04	-32.93	1.97	1.00E-06	76	22.7
01638500	-0.66	0.23	5.12E-03	-1.01	0.46	2.96E-02	-5.23	0.79	<1.00E-06	-6.27	0.81	1.00E-06	104	63.5
01640500	10.16	1.47	<1.00E-06	7.85	1.56	1.32E-06	-5.62	2.13	9.25E-03	12.04	0.88	1.00E-06	154	34.7
01642500	6.57	2.94	2.72E-02	4.84	1.76	6.81E-03	-4.42	3.11	1.58E-01	5.10	0.60	1.00E-06	127	32.5
01643700	-0.60	2.07	7.71E-01	-7.51	3.60	4.09E-02	18.94	5.96	2.26E-03	9.38	3.04	2.99E-03	67	26.6
01644000	4.40	0.42	<1.00E-06	2.92	0.51	<1.00E-06	14.93	0.72	<1.00E-06	21.13	0.64	1.00E-06	211	58.5
01646000	-0.24	0.46	5.95E-01	3.19	0.58	<1.00E-06	-2.09	0.90	2.03E-02	1.29	0.43	3.17E-03	260	61.6
01653500	27.41	2.20	<1.00E-06	-5.21	2.46	3.64E-02	-6.64	3.47	5.76E-02	23.95	1.99	1.00E-06	134	28.9
01654000	-2.01	1.70	2.41E-01	-13.65	1.52	<1.00E-06	-29.13	2.35	<1.00E-06	-40.67	2.05	1.00E-06	162	38.5
01656000	25.64	4.02	<1.00E-06	11.45	3.28	8.25E-04	4.88	5.60	3.87E-01	48.70	2.86	1.00E-06	73	33.6
01660920	13.15	2.20	<1.00E-06	8.36	3.34	1.43E-02	7.50	4.11	7.15E-02	23.78	4.22	1.00E-06	86	24.8
01661000	-8.12	1.69	5.34E-06	-3.53	3.89	3.66E-01	10.50	3.83	7.21E-03	3.88	2.03	5.94E-02	108	23.7
01666500	-2.52	0.50	<1.00E-06	-9.27	0.47	<1.00E-06	-8.75	0.50	<1.00E-06	-18.40	0.54	1.00E-06	269	58.7
01667500	4.38	0.22	<1.00E-06	5.63	0.37	<1.00E-06	2.01	0.53	1.70E-04	10.95	0.37	1.00E-06	285	59.8
01671020	-1.77	1.25	1.61E-01	6.74	1.53	2.15E-05	-15.19	1.59	<1.00E-06	-12.12	0.77	1.00E-06	145	32.3
01673550	10.09	2.84	6.41E-04	18.64	3.95	1.04E-05	4.61	4.36	2.94E-01	29.13	3.47	1.00E-06	79	21.5
01673800	0.31	0.93	7.43E-01	4.95	0.91	<1.00E-06	15.97	1.29	<1.00E-06	20.11	1.08	1.00E-06	203	49.2
02022500	-12.93	1.84	<1.00E-06	13.90	3.88	6.01E-04	-30.87	5.47	<1.00E-06	-57.78	6.14	1.00E-06	75	23.6
02029000	0.53	0.05	<1.00E-06	0.29	0.11	1.03E-02	-3.52	0.28	<1.00E-06	-2.55	0.26	1.00E-06	192	59.6
02038850	-1.73	0.76	2.42E-02	-1.97	0.74	8.24E-03	17.97	1.57	<1.00E-06	12.52	1.02	1.00E-06	167	42.5
02039000	0.93	2.19	6.74E-01	-19.01	2.00	<1.00E-06	-15.54	3.25	8.45E-06	-32.83	2.58	1.00E-06	77	37.7
02039500	3.17	0.20	<1.00E-06	-3.37	0.55	<1.00E-06	2.00	0.57	5.50E-04	1.87	0.42	1.30E-05	255	58.2
02040000	-2.49	1.02	1.69E-02	-5.16	1.07	7.35E-06	-1.45	1.43	3.12E-01	-8.74	1.29	1.00E-06	75	23.2
02041650	0.83	0.40	3.99E-02	-2.13	1.29	1.03E-01	0.57	1.82	7.53E-01	-1.76	1.14	1.25E-01	78	31.6
02045500	-0.28	0.23	2.31E-01	-3.98	0.75	<1.00E-06	-3.09	0.77	7.99E-05	-6.78	0.44	1.00E-06	289	58.4
02046000	16.12	1.89	<1.00E-06	14.86	2.79	<1.00E-06	-7.53	3.31	2.49E-02	19.11	2.22	1.00E-06	110	27.3
02051000	-6.17	1.82	9.98E-04	4.56	1.34	9.28E-04	36.31	2.56	<1.00E-06	33.20	1.42	1.00E-06	104	27.6
02052000	0.72	0.27	8.99E-03	1.12	0.66	9.12E-02	-16.49	1.53	<1.00E-06	-13.63	1.77	1.00E-06	107	30.4
02053500	-12.55	1.38	<1.00E-06	6.95	1.38	<1.00E-06	-9.59	1.32	<1.00E-06	-13.42	2.08	1.00E-06	270	47.5
02054530	-4.54	1.23	4.38E-04	1.58	3.13	6.16E-01	-3.44	2.08	1.04E-01	-6.91	0.81	1.00E-06	66	21.7
02056650	-1.24	1.10	2.61E-01	-1.51	1.31	2.51E-01	16.09	2.51	<1.00E-06	11.34	1.43	1.00E-06	92	25.2
02056900	1.39	0.54	1.06E-02	10.63	0.97	<1.00E-06	-12.97	0.93	<1.00E-06	-1.32	0.63	3.82E-02	120	31.7
02058400	2.35	0.23	<1.00E-06	-2.70	0.86	1.93E-03	3.98	0.95	4.86E-05	0.50	0.41	2.26E-01	169	51.5
02064000	1.37	0.20	<1.00E-06	-5.06	0.66	<1.00E-06	1.18	0.68	8.58E-02	-3.06	0.34	1.00E-06	243	61.2
02065500	-6.09	1.49	8.43E-05	-13.35	1.87	<1.00E-06	6.24	2.00	2.40E-03	-10.90	1.94	1.00E-06	104	29.4
02066000	-5.98	0.30	<1.00E-06	1.77	0.38	4.77E-06	0.97	0.33	4.09E-03	-3.31	0.32	1.00E-06	229	63.1
02069700	1.36	0.61	2.95E-02	2.17	1.42	1.29E-01	-8.52	2.00	4.71E-05	-5.69	0.86	1.00E-06	98	27.6
02070500	1.15	0.09	<1.00E-06	-4.85	0.52	<1.00E-06	4.65	0.52	<1.00E-06	0.81	0.30	3.11E-03	141	60.8
02071000	1.74	0.45	1.60E-04	10.97	0.55	<1.00E-06	3.88	0.54	<1.00E-06	16.06	0.50	1.00E-06	202	57.8
02073000	0.41	0.24	9.18E-02	-1.97	0.42	1.19E-05	-6.43	0.82	<1.00E-06	-7.20	0.99	1.00E-06	81	27.8
02074000	-0.65	0.13	1.20E-06	2.26	0.57	9.96E-05	1.52	0.54	5.07E-03	3.24	0.34	1.00E-06	189	63.0
02075500	3.97	0.13	<1.00E-06	-0.64	0.24	9.17E-03	-0.45	0.21	3.45E-02	2.69	0.21	1.00E-06	221	60.2
02082770	6.30	0.43	<1.00E-06	0.11	0.76	8.83E-01	0.67	0.99	4.96E-01	6.58	0.83	1.00E-06	238	48.8
02083500	-1.66	0.20	<1.00E-06	-0.20	0.34	5.55E-01	0.08	0.29	7.84E-01	-2.17	0.24	1.00E-06	192	58.3
02083800	-0.49	0.44	2.69E-01	1.27	0.70	7.04E-02	-19.56	1.05	<1.00E-06	-18.38	1.42	1.00E-06	254	45.4
02087500	2.50	0.15	<1.00E-06	-3.84	0.23	<1.00E-06	2.40	0.34	<1.00E-06	1.12	0.23	1.61E-06	255	63.0
02089000	-0.57	0.14	1.09E-04	4.07	0.47	<1.00E-06	-3.83	0.49	<1.00E-06	-0.06	0.35	3.71E-01	221	63.7
02091000	-5.03	1.30	1.69E-04	-13.90	1.95	<1.00E-06	24.42	3.70	<1.00E-06	-5.26	2.59	4.42E-02	126	30.1
02097517	4.50	3.19	1.61E-01	12.61	4.39	4.89E-03	-20.07	4.70	4.31E-05	-5.90	3.17	5.57E-02	105	25.0
02102192	12.79	2.26	<1.00E-06	7.29	1.98	3.17E-04	-20.40	3.66	<1.00E-06	-2.74	3.61	4.49E-01	162	41.5
02102908	-1.66	0.76	2.99E-02	12.99	1.25	<1.00E-06	-11.46	1.20	<1.00E-06	4.05	0.63	1.00E-06	113	30.2
02103000	0.64	0.95	5.04E-01	7.19	2.19	1.65E-03	-20.06	2.40	<1.00E-06	-17.68	1.83	1.00E-06	70	25.8
02110500	2.73	1.38	4.88E-02	3.58	1.55	2.17E-02	-2.97	1.50	4.96E-02	0.08	0.36	3.29E-01	170	52.9
02111000	1.28	1.33	3.38E-01	-9.44	2.43	2.35E-04	0.51	3.03	8.67E-01	-8.80	0.99	1.00E-06	70	29.7
02111500	-4.88	0.51	<1.00E-06	12.50	1.05	<1.00E-06	-6.54	1.29	2.61E-06	-0.05	0.62	9.33E-01	83	26.3
02112120	3.95	0.35	<1.00E-06	0.37	0.69	5.91E-01	-5.74	1.32	3.89E-05	-0.58	1.03	5.78E-01	81	24.6
02112360	1.72	0.42	6.18E-05	0.23	0.98	8.14E-01	4.59	1.07	2.83E-05	4.72	0.73	1.00E-06	177	58.9
02113000	0.34	0.21	1.02E-01	-2.39	0.60	9.51E-05	-2.16	0.65	1.02E-03	-4.60	0.23	1.00E-06	225	60.5
02114450	10.39	0.86	<1.00E-06	10.04	1.34	<1.00E-06	-8.75	1.36	<1.00E-06	5.53	0.80	1.00E-06	232	51.8
02115360	3.06	0.24	<1.00E-06	2.82	0.37	<1.00E-06	2.48	0.43	<1.00E-06	8.45	0.52	1.00E-06	118	41.6
02118000	1.38	0.23	<1.00E-06	-0.91	0.33	5.57E-03	-4.53	0.45	<1.00E-06	-3.38	0.20	1.00E-06	252	61.0
02118500	1.20	0.17	<1.00E-06	15.26	0.60	<1.00E-06	4.67	0.38	<1.00E-06	19.10	0.68	1.00E-06	308	58.3
02121500	9.84	1.90	1.79E-06	-7.41	2.17	1.04E-03	2.43	3.46	4.85E-01	6.99	2.82	1.56E-02	76	24.4
02123567	23.40	6.36	4.20E-04	-8.44	3.94	3.52E-02	-14.03	7.02	4.91E-02	8.81	5.30	1.01E-01	81	22.7
02125000	9.30	1.31	<1.00E-06	0.81	0.72	2.61E-01	-4.39	1.47	3.04E-03	3.51	0.37	1.00E-06	262	54.2
02128000	-3.19	0.38	<1.00E-06	-8.97	0.47	<1.00E-06	6.95	0.80	<1.00E-06	-3.91	0.67	1.00E-06	257	63.0
02130561	0.26	1.26	8.37E-01	-7.85	1.74	5.39E-05	13.02	3.07	1.26E-04	5.68	2.62	3.63E-02	41	21.0
02131000	0.25	0.31	4.26E-01	-1.36	0.40	9.22E-04	3.42	0.62	<1.00E-06	0.62	0.49	2.05E-01	136	56.9
02131309	6.27	3.18	5.15E-02	13.44	4.45	3.26E-03	18.58	4.11	1.82E-05	37.06	3.10	1.00E-06	94	20.6
02132000	-0.03	0.25	9.08E-01	0.78	0.51	1.29E-01	-0.99	0.51	5.27E-02	0.09	0.29	7.50E-01	205	47.5
02135300	4.04	2.08	5.46E-02	0.31	1.82	8.65E-01	-9.30	1.22	<1.00E-06	-3.49	1.58	2.94E-02	112	34.4
02142000	3.15	0.81	1.77E-04	5.13	1.05	4.17E-06	5.19	1.06	3.70E-06	15.23	1.17	1.00E-06	95	51.1
02143000	-7.88	0.71	<1.00E-06	-4.40	2.75	1.13E-01	7.29	3.06	1.96E-02	-6.58	0.81	1.00E-06	83	25.7
02143040	-1.68	1.37	2.25E-01	4.02	1.10	4.26E-04	-1.51	3.77	6.89E-01	1.79	3.06	5.60E-01	89	27.6
02144000	4.88	0.84	<1.00E-06	3.95	0.94	3.93E-05	-3.02	1.24	1.60E-02	6.22	0.32	1.00E-06	268	55.4

STAID	$\hat{w}$ (%/dec)	$\hat{w}$ SE (%/dec)	$\hat{w}$ p	$\hat{h}$ (%/dec)	$\hat{h}$ SE (%/dec)	$\hat{h}$ p	$\hat{U}$ (%/dec)	$\hat{U}$ SE (%/dec)	$\hat{U}$ p	$\hat{Q}$ (%/dec)	$\hat{Q}$ SE (%/dec)	$\hat{Q}$ p	N msts	N years
02145000	-0.81	0.16	1.23E-06	0.27	0.49	5.81E-01	1.51	0.54	5.44E-03	1.41	0.21	1.00E-06	123	62.4
02146300	-0.62	0.40	1.25E-01	12.11	0.72	<1.00E-06	5.47	0.68	<1.00E-06	16.21	0.78	1.00E-06	298	49.0
02146507	1.73	0.88	5.21E-02	3.58	0.83	3.24E-05	-14.48	1.79	<1.00E-06	-11.72	1.26	1.00E-06	134	35.6
02151500	-0.05	0.17	7.55E-01	5.40	0.87	<1.00E-06	-5.83	0.96	<1.00E-06	-0.45	0.51	3.76E-01	91	61.2
02152100	1.74	0.29	<1.00E-06	0.11	1.54	9.44E-01	-0.28	1.61	8.61E-01	-2.51	1.44	3.39E-02	135	34.6
02153780	-18.50	3.20	<1.00E-06	-1.93	2.47	4.36E-01	9.36	6.02	1.23E-01	-5.97	4.72	2.09E-01	90	21.6
02160105	1.04	0.42	1.57E-02	-5.52	0.98	<1.00E-06	-2.18	0.89	1.58E-02	-7.38	0.67	1.00E-06	111	37.9
02160700	1.91	0.41	6.74E-06	-6.37	0.92	<1.00E-06	-2.61	0.72	4.48E-04	-7.41	0.58	1.00E-06	120	37.7
02162093	-12.78	2.22	<1.00E-06	8.17	2.12	1.89E-04	-8.17	3.10	9.40E-03	-6.70	1.37	2.84E-06	125	36.8
02162350	-4.26	1.50	5.51E-03	4.22	1.71	1.53E-02	3.09	3.00	3.06E-01	3.62	1.92	5.27E-02	92	22.7
02173000	4.20	1.67	1.30E-02	-0.34	0.97	7.26E-01	0.89	0.61	1.48E-01	4.72	0.46	1.00E-06	123	52.2
02175000	0.98	0.09	<1.00E-06	-1.38	0.39	5.45E-04	-1.31	0.55	1.82E-02	-1.69	0.34	2.26E-06	168	57.2
02175500	3.27	2.70	2.30E-01	-0.99	1.96	6.17E-01	-3.76	1.99	6.29E-02	-3.40	1.24	7.73E-03	76	34.9
02186000	3.58	0.31	<1.00E-06	8.31	0.57	<1.00E-06	4.08	0.40	<1.00E-06	13.86	0.47	1.00E-06	90	52.4
02188500	-5.32	1.20	1.64E-05	9.45	2.33	7.46E-05	8.31	1.89	1.99E-05	3.13	3.55	3.78E-01	166	31.7
02191200	8.45	1.09	<1.00E-06	0.16	1.57	9.19E-01	-0.05	1.04	9.61E-01	8.04	1.44	1.00E-06	110	38.8
02192000	0.40	0.10	5.86E-05	-4.17	0.36	<1.00E-06	-1.55	0.26	<1.00E-06	-4.62	0.35	1.00E-06	248	62.7
02192500	-1.14	1.54	4.64E-01	10.87	2.57	6.33E-05	-1.03	2.96	7.28E-01	6.22	2.44	1.30E-02	76	20.4
02198000	1.42	0.15	<1.00E-06	1.06	0.22	1.56E-06	-3.14	0.38	<1.00E-06	-0.26	0.23	2.48E-01	254	62.3
02198100	-0.02	2.86	9.95E-01	-4.59	3.00	1.29E-01	-9.78	4.47	3.09E-02	-21.89	3.76	1.00E-06	104	25.0
02201000	20.25	1.70	<1.00E-06	-2.49	1.45	8.79E-02	0.75	1.61	6.43E-01	16.67	0.89	1.00E-06	123	33.6
02202600	0.89	2.14	6.77E-01	7.98	1.77	1.35E-05	-7.12	1.77	9.41E-05	-2.66	2.28	2.44E-01	142	44.2
02206500	-4.23	0.31	<1.00E-06	-6.53	0.62	<1.00E-06	8.13	0.71	<1.00E-06	-2.24	0.38	1.00E-06	190	51.7
02212600	2.60	0.95	6.75E-03	-2.41	1.16	3.90E-02	-3.30	0.96	7.20E-04	-1.33	1.67	4.25E-01	205	46.4
02213050	-12.53	2.41	<1.00E-06	7.23	2.29	1.89E-03	11.75	2.10	<1.00E-06	5.97	1.28	5.81E-06	166	32.6
02215000	1.10	0.83	1.91E-01	-6.42	1.74	6.17E-04	4.19	1.06	2.84E-04	-1.99	0.96	4.34E-02	44	28.5
02215500	2.91	0.24	<1.00E-06	-6.18	0.70	<1.00E-06	0.43	0.71	5.47E-01	-1.62	0.24	1.00E-06	237	60.7
02216180	4.83	1.59	3.09E-03	2.04	1.90	2.86E-01	-7.42	2.64	5.93E-03	-0.24	1.57	3.79E-01	95	25.2
02217475	1.81	0.84	3.35E-02	9.37	1.86	2.54E-06	3.86	1.54	1.38E-02	14.50	1.82	1.00E-06	85	21.0
02220550	-24.21	2.56	<1.00E-06	-34.17	3.32	<1.00E-06	-17.38	2.65	<1.00E-06	-66.61	4.40	1.00E-06	155	25.2
02223500	-0.22	0.18	2.28E-01	1.93	0.23	<1.00E-06	-2.57	0.39	<1.00E-06	-0.63	0.22	3.83E-03	235	54.1
02225000	2.13	0.64	1.10E-03	-0.92	1.24	4.58E-01	-0.03	1.09	9.77E-01	1.34	0.35	2.24E-04	123	42.9
02226000	-1.98	0.38	1.60E-06	1.70	1.02	1.00E-01	-2.63	0.88	3.83E-03	-4.83	0.53	1.00E-06	81	34.8
02227000	10.81	3.93	7.16E-03	10.74	3.99	8.48E-03	-6.44	5.39	2.35E-01	12.72	3.22	1.55E-04	92	29.2
02231280	3.72	0.54	<1.00E-06	8.72	0.58	<1.00E-06	-15.07	1.26	<1.00E-06	-2.69	0.93	4.47E-03	117	39.5
02233500	-0.81	0.65	2.15E-01	3.49	0.72	2.45E-06	5.93	0.91	<1.00E-06	9.17	0.91	1.00E-06	198	60.2
02234384	17.56	3.59	4.74E-06	41.61	5.34	<1.00E-06	38.84	9.35	7.82E-05	87.97	9.06	1.00E-06	85	20.7
02234400	11.43	2.49	1.58E-05	9.60	2.66	5.29E-04	-5.58	2.42	2.37E-02	15.32	3.01	2.19E-06	84	23.6
02236500	-6.54	1.19	<1.00E-06	6.24	1.38	1.37E-05	-2.07	1.26	1.02E-01	-3.53	1.27	5.42E-03	143	56.6
02240500	3.89	0.75	2.32E-06	0.28	0.52	5.91E-01	-11.50	1.60	<1.00E-06	-7.24	1.55	1.38E-05	71	33.5
02243000	-2.40	2.27	2.94E-01	3.75	4.52	4.10E-01	-1.26	4.55	7.83E-01	0.91	2.79	7.46E-01	86	23.9
02245140	-12.38	1.33	<1.00E-06	-14.91	1.73	<1.00E-06	18.51	2.52	<1.00E-06	-10.91	1.23	1.00E-06	97	28.4
02245255	-6.73	3.23	3.98E-02	-34.94	4.83	<1.00E-06	18.23	4.65	1.61E-04	-34.86	4.60	1.00E-06	104	31.3
02245500	-4.27	0.66	<1.00E-06	4.68	0.58	<1.00E-06	5.83	0.70	<1.00E-06	5.71	0.38	1.00E-06	224	58.5
02266200	10.87	2.60	7.75E-05	3.64	2.24	1.09E-01	-13.06	3.09	6.59E-05	5.67	1.80	2.36E-03	74	43.5
02266480	-1.85	1.67	2.72E-01	-24.20	3.86	<1.00E-06	9.21	3.63	1.29E-02	-17.57	2.22	1.00E-06	88	38.9
02269500	-1.49	1.32	2.62E-01	-6.02	1.32	1.61E-05	-9.33	2.55	4.18E-04	-23.71	2.75	1.00E-06	91	21.7
02291580	37.00	7.53	9.30E-06	21.22	7.84	9.21E-03	-5.87	10.25	5.69E-01	72.49	9.77	1.00E-06	53	21.1
02294217	-13.09	3.40	2.94E-04	-7.33	3.00	1.74E-02	10.66	6.59	1.11E-01	-12.08	3.04	1.94E-04	60	51.9
02294650	-1.54	2.38	5.18E-01	2.48	2.69	3.58E-01	-2.98	2.47	2.30E-01	-2.13	1.04	4.19E-02	140	34.6
02295420	-12.14	0.82	<1.00E-06	-8.77	1.37	<1.00E-06	22.38	2.12	<1.00E-06	0.41	1.55	7.92E-01	143	44.8
02297155	1.74	1.88	3.58E-01	7.05	1.97	4.98E-04	-3.42	1.93	7.90E-02	5.14	2.04	1.29E-02	112	31.0
02297310	0.06	0.91	9.45E-01	6.21	1.03	<1.00E-06	-0.15	0.78	8.49E-01	3.99	1.35	3.38E-03	247	57.2
02298123	10.40	1.04	<1.00E-06	22.23	1.50	<1.00E-06	3.17	1.71	6.46E-02	36.31	2.09	1.00E-06	167	43.7
02298202	0.48	0.16	3.93E-03	-3.56	0.81	3.35E-05	-12.82	1.28	<1.00E-06	-17.76	1.88	1.00E-06	85	44.5
02298760	-1.06	3.62	7.70E-01	-2.08	4.31	6.32E-01	-13.98	6.32	3.08E-02	-23.63	5.89	1.71E-04	61	28.4
02299950	4.01	1.28	2.06E-03	-3.99	1.63	1.54E-02	9.05	1.60	<1.00E-06	6.37	2.38	3.26E-03	158	42.0
02300100	15.31	3.14	3.74E-06	-9.30	2.82	1.35E-03	-13.47	3.29	8.46E-05	-7.02	2.41	4.40E-03	106	27.2
02301300	-12.06	1.75	<1.00E-06	-1.16	1.65	4.83E-01	0.68	1.59	6.69E-01	-9.67	1.23	1.00E-06	136	34.1
02301500	-1.28	1.09	2.47E-01	-0.28	1.25	8.27E-01	-2.06	1.22	9.40E-02	-2.91	0.82	5.66E-04	98	24.3
02301750	34.18	3.56	<1.00E-06	15.99	7.12	2.69E-02	-7.87	6.65	2.39E-01	29.25	10.78	7.79E-03	106	24.0
02306647	-1.89	0.49	3.36E-04	-9.55	4.18	2.67E-02	12.02	3.42	9.58E-04	4.85	3.58	1.83E-01	49	22.9
02307000	0.14	0.21	4.89E-01	9.85	2.70	4.26E-04	2.79	3.16	3.80E-01	18.63	3.60	1.19E-06	100	36.1
02307359	-4.90	0.84	<1.00E-06	1.80	0.85	3.56E-02	-1.82	1.48	2.21E-01	-4.62	1.32	5.58E-04	185	57.9
02312000	0.77	0.41	6.24E-02	3.84	0.51	<1.00E-06	-0.70	1.01	4.88E-01	3.92	0.89	1.48E-05	217	58.1
02312200	13.67	1.39	<1.00E-06	12.94	1.38	<1.00E-06	5.87	1.83	1.62E-03	28.17	2.00	1.00E-06	144	53.8
02314200	16.88	4.11	2.13E-04	14.42	3.64	3.26E-04	-1.89	4.07	6.45E-01	31.30	5.96	5.39E-06	38	31.7
02315000	-3.01	2.03	1.44E-01	-8.00	3.52	2.75E-02	14.40	5.27	8.71E-03	1.25	2.62	5.36E-01	50	24.7
02315500	0.55	0.56	3.28E-01	-11.21	2.89	2.18E-04	6.87	2.59	9.52E-03	-2.21	0.85	1.14E-02	82	28.0
02317500	-0.37	0.32	2.54E-01	1.11	0.37	3.16E-03	1.59	0.30	<1.00E-06	1.99	0.30	1.00E-06	299	63.4
02319000	3.26	0.12	<1.00E-06	3.40	0.25	<1.00E-06	-4.50	0.46	<1.00E-06	2.62	0.28	1.00E-06	189	59.5
02320500	0.61	0.10	<1.00E-06	0.94	0.48	5.30E-02	-1.81	0.60	2.94E-03	-0.43	0.43	3.16E-01	158	62.6
02321000	0.87	0.77	2.60E-01	2.21	0.96	2.28E-02	-14.34	1.29	<1.00E-06	-11.01	0.94	1.00E-06	146	62.3
02324400	1.23	3.54	7.30E-01	8.12	2.73	3.76E-03	-23.71	5.40	2.97E-05	-9.07	4.05	2.75E-02	96	28.8
02327100	2.36	0.66	4.94E-04	4.81	0.93	<1.00E-06	-0.54	0.82	5.14E-01	6.60	0.94	1.00E-06	162	49.6
02327500	-10.64	1.47	<1.00E-06	-12.84	1.74	<1.00E-06	0.87	2.10	6.80E-01	-41.01	2.17	1.00E-06	151	57.3
02329000	-5.50	0.78	<1.00E-06	-12.10	1.27	<1.00E-06	11.33	1.71	<1.00E-06	-7.49	1.06	1.00E-06	101	36.5
02330450	-4.13	0.82	1.76E-06	-5.11	0.73	<1.00E-06	14.30	0.78	<1.00E-06	3.06	0.78	1.44E-04	110	27.1
02331000	3.40	0.39	<1.00E-06	5.68	1.12	1.62E-06	-4.54	1.07	4.11E-05	4.55	0.64	1.00E-06	119	21.0
02333500	1.53	0.26	<1.00E-06	-2.43	0.53	7.69E-06	4.30	0.51	<1.00E-06	2.36	0.28	1.00E-06	258	57.9
02335000	-0.39	0.09	2.13E-05	5.52	0.29	<1.00E-06	-1.89	0.30	<1.00E-06	2.67	0.26	1.00E-06	300	52.2
02335450	0.10	0.20	6.28E-01	-3.28	0.91	4.50E-04	7.56	0.91	<1.00E-06	4.72	0.58	1.00E-06	106	34.0
02336000	0.22	0.14	1.30E-01	-4.18	0.51	<1.00E-06	4.08	0.68	<1.00E-06	-0.06	0.38	3.74E-01	157	40.4
02336300	6.00	1.18	<1.00E-06	9.59	1.17	<1.00E-06	6.65	0.77	<1.00E-06	21.13	1.67	1.00E-06	245	41.5
02336490	2.02	1.01	4.76E-02	-5.15	1.09	6.68E-06	0.71	0.49	1.46E-01	-2.27	0.50	1.68E-05	108	30.4

STAID	$\hat{w}$ (%/dec)	$\hat{w}$ SE (%/dec)	$\hat{w}$ p	$\hat{h}$ (%/dec)	$\hat{h}$ SE (%/dec)	$\hat{h}$ p	$\hat{U}$ (%/dec)	$\hat{U}$ SE (%/dec)	$\hat{U}$ p	$\hat{Q}$ (%/dec)	$\hat{Q}$ SE (%/dec)	$\hat{Q}$ p	N msts	N years
02337170	1.99	0.19	<1.00E-06	11.07	0.78	<1.00E-06	-6.82	0.60	<1.00E-06	7.42	0.37	1.00E-06	158	44.3
02338000	1.87	0.11	<1.00E-06	0.48	0.28	9.03E-02	-2.80	0.34	<1.00E-06	-0.15	0.27	5.84E-01	166	45.7
02346500	-2.26	0.83	7.50E-03	1.24	0.78	1.13E-01	-5.75	1.44	1.16E-04	-5.61	1.51	3.10E-04	109	51.4
02347500	-0.76	0.35	2.78E-02	4.38	0.57	<1.00E-06	-1.42	0.46	2.18E-03	2.23	0.23	1.00E-06	241	60.4
02350900	4.02	0.71	<1.00E-06	3.98	1.51	9.44E-03	0.81	1.41	5.65E-01	6.63	0.78	1.00E-06	127	44.9
02353000	-1.38	0.15	<1.00E-06	4.99	0.25	<1.00E-06	-2.15	0.25	<1.00E-06	1.55	0.13	1.00E-06	209	58.3
02353400	11.02	0.61	<1.00E-06	-1.29	0.62	3.95E-02	-3.31	0.94	5.86E-04	5.38	0.34	1.00E-06	156	51.1
02357000	8.74	0.41	<1.00E-06	-1.28	0.38	9.54E-04	-6.81	0.43	<1.00E-06	1.74	0.26	1.00E-06	236	59.2
02363000	2.29	0.97	2.05E-02	-0.97	1.19	4.16E-01	-0.44	2.16	8.39E-01	-0.13	1.89	9.45E-01	87	25.9
02365500	0.67	0.17	8.41E-05	-0.64	0.33	5.23E-02	-3.46	0.53	<1.00E-06	-3.32	0.35	1.00E-06	151	57.1
02368000	2.17	0.73	3.42E-03	-2.55	1.08	1.94E-02	3.84	1.02	2.27E-04	5.42	0.33	1.00E-06	171	60.6
02369000	-0.25	0.48	5.97E-01	-3.52	0.52	<1.00E-06	-2.74	0.45	<1.00E-06	-6.38	0.30	1.00E-06	160	58.7
02370500	4.45	1.29	8.47E-04	-2.36	1.22	5.60E-02	-1.43	0.79	7.42E-02	0.40	0.53	4.47E-01	91	45.1
02371500	3.82	0.80	5.12E-06	4.83	1.07	1.74E-05	-0.92	1.24	4.59E-01	8.27	0.83	1.00E-06	108	34.3
02373000	2.65	1.19	2.78E-02	-4.46	3.14	1.58E-01	-6.30	2.38	9.27E-03	-10.19	1.48	1.00E-06	106	28.7
02374500	-9.84	1.00	<1.00E-06	0.25	0.85	7.71E-01	-0.38	1.48	8.00E-01	-10.68	1.21	1.00E-06	91	30.8
02377570	-0.49	0.91	5.94E-01	-3.38	1.61	3.89E-02	-8.34	1.69	4.52E-06	-13.11	1.24	1.00E-06	78	21.9
02380500	2.27	0.11	<1.00E-06	2.09	0.19	<1.00E-06	2.05	0.49	3.60E-05	6.43	0.48	1.00E-06	186	42.8
02381600	-0.10	1.17	9.31E-01	-3.24	1.34	1.68E-02	-8.35	1.81	8.53E-06	-9.36	2.15	2.59E-05	145	44.0
02382200	3.47	0.48	<1.00E-06	-2.65	0.82	1.56E-03	-0.69	1.30	5.97E-01	-0.38	1.21	7.54E-01	136	39.8
02383500	2.61	0.26	<1.00E-06	-2.53	0.59	3.23E-05	-0.55	0.67	4.07E-01	-0.50	0.51	3.22E-01	126	36.3
02384500	9.73	1.22	<1.00E-06	-13.08	2.10	<1.00E-06	-0.13	2.20	9.53E-01	-3.61	1.63	2.86E-02	108	27.5
02387500	2.01	0.40	2.03E-06	0.09	0.51	8.61E-01	-3.21	0.64	1.81E-06	-0.07	0.51	3.97E-01	117	33.3
02388500	0.79	0.33	1.85E-02	-0.14	0.41	7.26E-01	-3.21	1.92	9.76E-02	-4.45	1.67	9.13E-03	95	32.4
02392000	5.39	0.22	<1.00E-06	3.10	0.36	<1.00E-06	-4.20	0.31	<1.00E-06	4.63	0.31	1.00E-06	267	58.6
02397000	-1.07	0.34	1.79E-03	-2.96	0.37	<1.00E-06	18.59	0.74	<1.00E-06	15.23	0.40	1.00E-06	183	45.5
02398000	3.09	0.36	<1.00E-06	1.92	0.52	2.71E-04	-3.85	0.73	<1.00E-06	0.11	0.40	7.84E-01	263	61.9
02398300	5.90	0.98	<1.00E-06	10.23	1.64	<1.00E-06	7.67	2.14	5.32E-04	24.00	1.03	1.00E-06	97	27.8
02406500	1.83	3.76	6.29E-01	-6.26	8.47	4.62E-01	-6.79	7.04	3.38E-01	1.03	3.12	7.43E-01	79	25.6
02408540	8.22	1.42	<1.00E-06	11.35	2.31	3.49E-06	5.43	3.30	1.03E-01	20.52	1.80	1.00E-06	98	30.7
02411930	9.92	2.61	6.07E-04	1.40	1.22	2.62E-01	1.47	3.79	7.00E-01	2.24	1.68	1.91E-01	33	37.8
02412000	2.49	0.95	1.05E-02	-3.91	1.35	4.59E-03	2.64	1.84	1.55E-01	0.02	0.76	9.82E-01	96	31.0
02414500	-3.12	0.72	7.01E-05	-3.36	2.39	1.67E-01	-6.35	3.43	7.06E-02	-12.82	3.02	1.04E-04	48	25.7
02419000	18.67	2.75	<1.00E-06	27.93	2.15	<1.00E-06	1.54	2.45	5.32E-01	43.21	4.12	1.00E-06	101	26.9
02421000	2.46	3.08	4.27E-01	9.49	4.68	4.54E-02	-14.10	4.25	1.31E-03	2.47	4.00	5.38E-01	92	29.5
02422500	13.05	2.16	<1.00E-06	18.59	2.86	<1.00E-06	19.92	1.88	<1.00E-06	42.53	2.80	1.00E-06	99	26.0
02423400	3.75	2.20	9.20E-02	17.70	2.59	<1.00E-06	-0.30	4.20	9.43E-01	24.70	1.29	1.00E-06	93	22.0
02424590	1.73	0.82	3.96E-02	0.50	1.48	7.35E-01	-19.09	2.57	<1.00E-06	-15.54	2.39	1.00E-06	65	23.8
02425000	2.48	0.51	5.82E-06	-5.08	1.31	2.12E-04	-1.66	1.06	1.21E-01	-3.09	0.73	5.76E-05	85	29.4
02427250	0.10	1.09	9.28E-01	14.13	2.42	<1.00E-06	4.42	1.31	1.09E-03	19.72	2.04	1.00E-06	81	51.9
02429900	17.42	2.27	<1.00E-06	18.87	3.30	<1.00E-06	0.60	2.20	7.84E-01	31.52	4.87	1.00E-06	141	51.1
02430615	1.53	1.43	2.85E-01	-0.79	3.49	8.21E-01	-8.84	2.50	5.91E-04	-11.76	4.62	1.22E-02	120	28.2
02436500	0.64	1.63	6.95E-01	-7.42	3.02	1.56E-02	3.62	2.89	2.12E-01	-2.10	2.92	4.75E-01	117	30.5
02438000	0.00	0.41	9.92E-01	-4.44	0.79	<1.00E-06	6.36	0.92	<1.00E-06	4.02	0.57	1.00E-06	155	53.0
02446500	1.51	0.39	1.40E-04	-6.40	0.46	<1.00E-06	-0.66	0.75	3.77E-01	-6.47	0.41	1.00E-06	167	53.0
02448900	0.53	6.38	9.34E-01	-5.64	5.32	2.92E-01	-15.86	6.40	1.53E-02	-22.27	8.03	6.95E-03	79	21.3
02449245	-9.65	1.94	2.36E-06	-3.80	1.97	5.61E-02	10.57	3.30	1.75E-03	-6.21	3.42	7.18E-02	116	22.8
02450250	11.19	2.13	<1.00E-06	12.63	2.31	<1.00E-06	-10.80	2.78	1.71E-04	10.33	2.31	1.86E-05	115	28.5
02453000	0.94	0.42	2.65E-02	-1.41	0.52	7.14E-03	-6.53	0.77	<1.00E-06	-6.17	0.61	1.00E-06	186	57.6
02464360	-3.37	1.45	2.23E-02	-3.34	3.25	3.08E-01	4.56	3.26	1.64E-01	-1.84	1.17	1.20E-01	105	27.0
02465493	3.77	1.09	7.25E-04	6.97	1.66	4.65E-05	-12.43	2.10	<1.00E-06	1.59	1.38	2.49E-01	143	31.2
02469800	-4.70	1.49	2.08E-03	14.42	1.42	<1.00E-06	3.27	1.39	2.02E-02	12.16	1.04	1.00E-06	106	30.7
02471001	-1.84	0.93	5.09E-02	-2.03	1.49	1.77E-01	0.80	1.17	4.95E-01	-2.57	0.84	2.86E-03	100	29.1
02476600	12.42	1.51	<1.00E-06	-2.96	2.36	2.11E-01	-9.73	1.53	<1.00E-06	4.12	2.46	9.61E-02	136	30.4
02477000	5.78	1.18	3.02E-06	0.37	1.14	7.47E-01	1.09	1.34	4.18E-01	7.81	0.91	1.00E-06	124	30.1
02477990	4.32	0.47	<1.00E-06	2.26	0.73	2.35E-03	7.64	0.74	<1.00E-06	13.51	0.71	1.00E-06	131	30.9
02479000	-0.43	0.43	3.18E-01	1.96	0.72	6.76E-03	3.08	0.61	<1.00E-06	3.67	0.32	1.00E-06	218	58.6
02479155	-0.51	1.37	7.10E-01	-7.11	1.94	3.78E-04	4.81	3.23	1.39E-01	3.59	3.10	2.50E-01	124	28.8
02479300	-1.64	0.55	3.35E-03	5.21	1.35	1.86E-04	-2.98	1.49	4.76E-02	1.48	0.79	6.37E-02	132	54.2
02479560	7.09	0.47	<1.00E-06	3.35	2.90	2.52E-01	-13.39	3.39	1.48E-04	-2.41	1.38	3.28E-02	102	30.9
02481510	16.38	2.64	<1.00E-06	15.33	3.18	6.11E-06	-0.77	2.84	7.87E-01	30.37	2.22	1.00E-06	87	22.1
02484000	-2.16	1.37	1.17E-01	-6.51	2.80	2.19E-02	-31.24	2.32	<1.00E-06	-38.02	2.15	1.00E-06	124	31.1
02489500	1.49	0.54	7.77E-03	4.10	1.00	1.01E-04	-7.35	0.90	<1.00E-06	-1.16	0.47	1.55E-02	81	58.1
03022540	-1.17	1.43	4.16E-01	-7.79	1.58	2.79E-06	-11.23	2.03	<1.00E-06	-22.52	2.20	1.00E-06	114	35.6
03028000	5.74	0.43	<1.00E-06	4.68	0.60	<1.00E-06	-0.88	0.94	3.51E-01	9.34	0.72	1.00E-06	223	53.9
03039000	3.07	0.56	<1.00E-06	-0.08	0.72	9.08E-01	5.49	0.87	<1.00E-06	8.57	0.42	1.00E-06	185	58.6
03056250	-1.31	1.04	2.13E-01	-3.23	1.23	1.04E-02	-1.04	1.58	5.12E-01	-2.25	2.02	2.71E-01	73	23.6
03065400	4.69	1.57	5.01E-03	9.55	4.48	3.95E-02	-14.13	5.13	9.13E-03	-0.69	1.42	6.31E-01	38	23.3
03076600	3.84	0.61	<1.00E-06	-4.61	0.87	<1.00E-06	1.13	0.98	2.51E-01	2.48	0.48	1.00E-06	188	43.6
03080000	2.29	0.41	<1.00E-06	1.49	0.43	6.78E-04	-4.06	0.73	<1.00E-06	0.48	0.32	1.33E-01	236	63.4
03083000	-12.86	3.15	6.68E-05	11.69	1.99	<1.00E-06	6.14	2.96	3.92E-02	3.35	1.00	1.02E-03	175	27.7
03084000	6.35	1.83	6.11E-04	-1.68	1.71	3.25E-01	-4.30	2.23	5.50E-02	-4.22	3.63	2.46E-01	230	42.7
03102500	3.01	0.41	<1.00E-06	-0.94	0.66	1.58E-01	-1.46	0.67	3.10E-02	0.25	0.38	5.11E-01	257	60.0
03102850	0.19	0.37	6.12E-01	1.37	0.44	2.09E-03	-2.89	0.76	1.82E-04	-1.52	0.99	1.28E-01	162	44.6
03106000	3.43	0.51	<1.00E-06	-0.41	0.72	5.75E-01	-7.20	0.74	<1.00E-06	-3.04	0.83	3.16E-04	226	62.0
03106500	0.48	0.37	1.97E-01	0.40	0.45	3.85E-01	5.61	0.51	<1.00E-06	6.01	0.60	1.00E-06	216	59.9
03131500	-0.32	0.48	5.02E-01	-2.02	0.63	3.51E-03	1.20	0.49	2.14E-02	-1.01	0.49	4.90E-02	30	42.9
03144000	6.57	2.30	5.86E-03	-1.50	2.89	6.05E-01	-8.91	4.74	6.50E-02	-4.17	3.15	1.92E-01	58	22.8
03151400	12.28	1.21	<1.00E-06	-1.80	1.47	2.23E-01	-1.80	1.20	1.36E-01	5.27	1.60	1.24E-03	136	38.9
03153500	0.44	1.17	7.08E-01	-0.10	1.11	9.32E-01	0.45	1.47	7.58E-01	0.91	1.00	3.67E-01	55	30.0
03167000	-0.87	0.16	<1.00E-06	1.38	0.29	4.50E-06	-2.26	0.33	<1.00E-06	-1.66	0.20	1.00E-06	260	58.3
03168000	-0.53	0.05	<1.00E-06	0.33	0.13	1.52E-02	-2.50	0.19	<1.00E-06	-2.86	0.15	1.00E-06	223	63.8
03173000	-0.35	0.58	5.47E-01	3.50	0.39	<1.00E-06	-2.74	0.52	<1.00E-06	0.60	0.16	2.83E-04	246	58.4
03185400	0.80	0.21	2.46E-04	-0.23	0.27	3.93E-01	0.17	0.39	6.68E-01	0.92	0.37	1.66E-02	77	27.4
03190000	-0.22	0.24	3.59E-01	-1.81	0.41	6.17E-05	1.61	0.60	9.81E-03	-0.75	0.57	1.93E-01	42	21.7

STAID	$\hat{w}$ (%/dec)	$\hat{w}$ SE (%/dec)	$\hat{w}$ p	$\hat{b}$ (%/dec)	$\hat{b}$ SE (%/dec)	$\hat{b}$ p	$\hat{U}$ (%/dec)	$\hat{U}$ SE (%/dec)	$\hat{U}$ p	$\hat{Q}$ (%/dec)	$\hat{Q}$ SE (%/dec)	$\hat{Q}$ p	N msts	N years
03208500	-1.62	0.31	<1.00E-06	-2.91	0.38	<1.00E-06	-5.52	0.73	<1.00E-06	-10.16	0.39	1.00E-06	275	63.9
03209200	-2.86	0.98	3.93E-03	2.05	1.62	2.07E-01	2.82	1.47	5.75E-02	2.66	0.73	3.79E-04	130	39.8
03216600	-1.43	0.44	2.11E-03	3.55	0.43	<1.00E-06	-1.07	0.71	1.37E-01	1.42	0.73	5.69E-02	51	41.5
03217000	1.20	1.37	3.84E-01	0.81	0.85	3.41E-01	4.20	0.99	3.27E-05	9.43	1.68	1.00E-06	248	63.9
03228805	16.76	2.29	<1.00E-06	18.15	3.03	<1.00E-06	10.15	4.47	2.71E-02	46.56	5.18	1.00E-06	55	23.2
03234000	1.13	1.71	5.12E-01	-0.60	2.15	7.81E-01	-1.37	2.55	5.95E-01	2.33	3.95	5.59E-01	33	22.7
03249500	2.08	0.20	<1.00E-06	0.11	0.25	6.75E-01	-3.90	0.60	<1.00E-06	-1.81	0.48	2.06E-04	141	47.5
03251200	0.66	1.41	6.42E-01	4.17	3.96	2.95E-01	-15.36	5.60	7.77E-03	-12.00	3.22	3.96E-04	70	20.7
03251500	8.41	0.88	<1.00E-06	-0.07	0.49	8.90E-01	-9.08	0.80	<1.00E-06	-1.99	0.56	4.12E-04	199	55.8
03252000	2.59	1.00	1.02E-02	-7.90	1.42	<1.00E-06	-6.33	2.19	4.36E-03	-9.68	1.51	1.00E-06	185	38.2
03252300	-5.38	2.30	2.21E-02	-5.96	4.31	1.71E-01	6.34	6.51	3.34E-01	-8.60	4.42	5.56E-02	76	42.8
03277500	-1.19	1.43	4.06E-01	-0.70	1.35	6.08E-01	-3.44	1.82	6.02E-02	-6.12	1.37	1.65E-05	126	42.3
03282000	1.19	0.26	9.75E-06	-8.62	0.49	<1.00E-06	3.65	0.61	<1.00E-06	-3.10	0.65	4.58E-06	132	58.3
03289000	-3.48	0.77	9.73E-06	-0.63	1.01	5.33E-01	-5.25	1.28	5.47E-05	-8.40	1.45	1.00E-06	244	57.9
03289300	4.61	0.63	<1.00E-06	-14.68	2.40	<1.00E-06	-3.14	2.02	1.24E-01	-12.46	1.85	1.00E-06	116	25.7
03291500	18.50	1.75	<1.00E-06	4.93	1.32	2.54E-04	-0.25	1.59	8.77E-01	18.63	2.00	1.00E-06	181	48.0
03291780	-20.04	5.39	3.35E-04	-12.99	4.92	9.62E-03	-22.02	7.68	5.09E-03	-38.78	11.05	5.82E-04	99	23.8
03294000	8.04	1.95	9.31E-05	12.26	2.57	8.16E-06	-11.94	3.28	4.96E-04	8.53	2.09	1.10E-04	79	28.0
03294550	14.68	3.20	2.07E-05	6.43	3.09	4.17E-02	-27.34	8.41	1.81E-03	-1.26	6.79	3.54E-01	67	20.3
03295000	25.72	4.97	1.40E-06	6.57	4.84	1.78E-01	9.87	6.29	1.20E-01	39.16	5.37	1.00E-06	89	20.5
03295890	4.62	2.04	2.53E-02	-1.92	2.40	4.25E-01	13.06	3.50	2.99E-04	16.05	2.23	1.00E-06	119	27.1
03298300	21.18	3.92	<1.00E-06	-3.10	4.83	5.23E-01	3.98	7.21	5.82E-01	18.14	6.44	5.89E-03	94	24.3
03298500	1.08	0.78	1.70E-01	0.86	0.39	2.75E-02	5.36	0.95	<1.00E-06	7.53	0.75	1.00E-06	130	43.8
03301900	9.55	3.68	1.10E-02	32.21	4.06	<1.00E-06	-17.97	4.79	3.03E-04	17.50	6.17	5.58E-03	93	24.2
03302300	11.32	4.70	1.79E-02	4.44	4.22	2.96E-01	9.22	2.95	2.35E-03	18.38	7.06	1.08E-02	94	32.9
03304500	-15.02	6.15	1.67E-02	-9.06	4.54	4.89E-02	23.97	6.28	2.53E-04	14.19	3.25	3.44E-05	89	20.4
03310000	-16.48	4.13	1.15E-04	-19.89	4.29	9.16E-06	-9.28	4.55	4.36E-02	-36.44	5.71	1.00E-06	118	23.5
03310400	5.42	0.83	<1.00E-06	8.83	1.41	<1.00E-06	8.43	1.57	<1.00E-06	22.85	0.87	1.00E-06	180	34.7
03311500	-3.02	0.64	5.30E-06	1.08	0.81	1.82E-01	3.79	0.95	1.05E-04	2.74	0.33	1.00E-06	147	42.5
03319000	5.62	0.50	<1.00E-06	-8.62	0.52	<1.00E-06	3.83	0.63	<1.00E-06	1.79	0.53	3.21E-04	194	54.1
03322900	12.12	1.54	<1.00E-06	-0.79	1.69	6.42E-01	0.57	2.54	8.22E-01	12.65	1.20	1.00E-06	75	28.8
03330500	-0.94	0.56	9.90E-02	-9.58	1.21	<1.00E-06	12.09	1.65	<1.00E-06	3.30	1.23	3.86E-03	79	48.1
03331500	-2.63	0.72	4.89E-04	1.27	0.73	8.54E-02	-4.17	1.19	7.62E-04	-4.41	1.02	3.92E-05	87	46.6
03333450	1.19	0.62	5.94E-02	-3.91	1.00	1.73E-04	1.22	1.34	3.62E-01	-0.70	1.38	6.13E-01	91	47.0
03335000	5.29	1.64	1.74E-03	3.48	2.75	2.10E-01	1.23	2.45	6.16E-01	7.36	1.25	1.00E-06	94	25.0
03336900	-5.76	0.99	<1.00E-06	-9.53	2.62	5.47E-04	-20.16	2.67	<1.00E-06	-33.05	2.80	1.00E-06	65	26.9
03339500	-3.06	3.65	4.04E-01	-4.67	4.73	3.27E-01	-4.94	4.75	3.01E-01	-2.94	1.36	3.40E-02	70	22.8
03341500	0.67	0.67	3.27E-01	2.39	1.32	7.94E-02	-3.57	1.21	5.36E-03	-0.19	0.62	7.54E-01	39	26.9
03342000	-1.59	0.14	<1.00E-06	1.91	0.49	1.63E-04	-4.16	0.48	<1.00E-06	-4.18	0.23	1.00E-06	181	61.3
03353800	-6.67	1.99	1.12E-03	11.99	2.84	5.39E-05	17.74	2.72	<1.00E-06	29.98	3.70	1.00E-06	103	37.3
03360000	0.85	0.87	3.33E-01	-2.31	1.12	4.18E-02	-2.69	0.74	4.51E-04	-5.04	0.73	1.00E-06	83	45.9
03360500	-4.40	0.94	1.31E-05	13.06	1.62	<1.00E-06	-14.83	1.70	<1.00E-06	-6.50	0.88	1.00E-06	70	27.9
03361500	-2.63	1.18	2.77E-02	-8.21	1.49	<1.00E-06	3.69	1.71	3.30E-02	-5.81	1.43	9.86E-05	97	51.7
03361650	-7.82	2.29	9.04E-04	-1.26	1.83	4.92E-01	-4.51	2.48	7.19E-02	-10.03	1.27	1.00E-06	102	27.3
03361850	18.42	1.23	<1.00E-06	7.11	2.07	7.70E-04	-7.98	2.33	8.13E-04	21.09	2.36	1.00E-06	145	42.6
03363500	-0.87	0.59	1.44E-01	0.89	0.57	1.21E-01	1.59	0.69	2.29E-02	0.92	0.53	3.56E-02	231	60.4
03369500	-7.16	3.67	5.50E-02	-0.70	4.18	8.67E-01	-7.60	5.19	1.47E-01	-12.03	5.29	2.57E-02	77	24.2
03374000	-2.52	1.32	6.13E-02	5.47	1.63	1.44E-03	-2.75	1.87	1.47E-01	-1.01	0.94	2.87E-01	54	28.0
03376500	7.17	0.89	<1.00E-06	-1.04	0.96	2.83E-01	1.60	1.20	1.85E-01	6.53	0.89	1.00E-06	82	24.8
03379500	0.99	0.98	3.13E-01	-9.20	1.33	<1.00E-06	14.01	2.70	<1.00E-06	3.61	1.31	5.63E-03	117	31.7
03402000	2.41	1.35	7.69E-02	8.35	1.46	<1.00E-06	-19.14	2.03	<1.00E-06	-5.62	1.00	1.00E-06	123	28.6
03409500	2.89	1.13	1.26E-02	3.12	1.91	1.07E-01	-4.43	2.30	5.87E-02	1.40	1.00	1.66E-01	70	24.7
03415000	6.14	2.86	3.79E-02	-3.57	2.69	1.91E-01	5.55	3.74	1.46E-01	8.80	1.27	1.00E-06	43	28.8
03416000	-18.37	2.40	<1.00E-06	-7.70	2.78	7.33E-03	12.77	3.23	1.91E-04	-20.25	3.00	1.00E-06	65	24.2
03427500	11.37	1.87	<1.00E-06	-6.26	1.94	1.85E-03	1.86	2.62	4.79E-01	9.63	1.51	1.00E-06	83	24.5
03428200	-1.46	1.13	1.98E-01	-5.29	2.80	6.24E-02	2.82	2.57	2.77E-01	-3.68	1.34	7.45E-03	85	22.2
03432400	11.81	2.64	2.20E-05	8.87	3.25	7.61E-03	11.73	4.33	8.09E-03	35.99	5.16	1.00E-06	92	44.4
03433500	5.57	0.26	<1.00E-06	-3.40	0.57	<1.00E-06	-0.91	0.67	1.75E-01	1.33	0.33	3.60E-05	314	58.5
03436100	-1.56	1.31	2.35E-01	3.60	1.97	7.07E-02	-1.82	1.35	1.81E-01	-0.73	1.81	5.88E-01	94	27.8
03443000	3.03	0.14	<1.00E-06	-1.15	0.20	<1.00E-06	-11.41	0.27	<1.00E-06	-9.52	0.22	1.00E-06	276	60.5
03446000	0.59	0.11	<1.00E-06	-0.51	0.21	1.73E-02	2.11	0.22	<1.00E-06	2.17	0.16	1.00E-06	290	59.4
03448500	2.98	0.43	<1.00E-06	2.85	0.95	3.02E-03	-6.45	1.04	<1.00E-06	-1.41	0.58	1.64E-02	174	27.8
03453500	0.13	0.06	3.49E-02	1.16	0.16	<1.00E-06	0.23	0.18	1.97E-01	1.19	0.17	1.00E-06	216	59.5
03471500	3.18	0.16	<1.00E-06	-0.28	0.27	3.06E-01	-7.03	0.51	<1.00E-06	-5.14	0.51	1.00E-06	284	58.1
03473000	1.86	0.13	<1.00E-06	-1.00	0.33	2.54E-03	6.42	0.37	<1.00E-06	7.14	0.36	1.00E-06	274	63.4
03479000	-1.45	0.78	6.58E-02	2.10	1.13	6.59E-02	3.89	1.15	1.07E-03	3.10	0.80	1.98E-04	85	28.8
03500240	0.79	0.27	4.01E-03	-0.27	0.54	6.19E-01	-1.02	0.70	1.48E-01	-0.73	0.41	7.82E-02	217	55.3
03531500	1.42	0.09	<1.00E-06	0.94	0.18	<1.00E-06	3.58	0.30	<1.00E-06	5.99	0.29	1.00E-06	273	58.3
03545000	2.73	0.21	<1.00E-06	16.46	0.66	<1.00E-06	5.97	0.94	<1.00E-06	25.47	1.26	1.00E-06	187	32.0
03558000	1.37	0.08	<1.00E-06	0.31	0.11	7.90E-03	-3.30	0.21	<1.00E-06	-1.68	0.22	1.00E-06	219	45.9
03559000	0.92	0.33	6.93E-03	-0.48	0.47	3.07E-01	-2.58	0.69	4.11E-04	-2.32	0.66	3.24E-04	67	22.8
03592718	14.31	3.07	8.23E-06	12.86	4.19	2.62E-03	9.72	2.80	7.24E-04	28.28	5.45	1.00E-06	126	30.5
03603000	0.34	0.62	5.80E-01	8.50	1.69	6.01E-06	-10.53	1.91	1.01E-06	-0.65	1.58	5.85E-01	54	29.8
03604400	3.25	2.46	1.98E-01	5.20	3.99	2.04E-01	-5.84	3.86	1.42E-01	0.74	1.96	7.07E-01	29	21.2
03611260	13.12	3.07	3.12E-05	0.65	3.44	8.50E-01	-5.70	3.20	7.68E-02	6.64	6.87	3.35E-01	186	36.7
04015330	-2.26	2.26	3.19E-01	7.82	1.99	1.53E-04	-5.43	2.77	5.28E-02	-3.78	1.98	5.89E-02	113	32.9
04024098	11.77	3.47	1.23E-03	-6.71	5.01	1.85E-01	8.53	5.64	1.36E-01	10.26	5.80	3.18E-02	61	25.1
04024430	1.04	1.41	4.65E-01	-1.39	2.14	5.17E-01	-4.08	2.87	1.62E-01	-1.49	1.30	2.57E-01	52	21.9
04027500	0.08	0.21	6.96E-01	-7.98	0.56	<1.00E-06	2.49	0.61	9.17E-05	-3.68	0.46	1.00E-06	113	58.9
04033000	2.51	0.32	<1.00E-06	-3.22	0.41	<1.00E-06	1.65	0.62	8.39E-03	0.11	0.41	7.88E-01	120	57.3
04036000	-0.98	0.47	3.78E-02	0.16	0.49	7.52E-01	-3.43	0.80	5.11E-05	-4.19	0.75	1.00E-06	84	22.0
04037500	-0.03	1.06	9.75E-01	-0.50	1.14	6.65E-01	5.99	1.23	4.38E-06	6.59	0.70	1.00E-06	92	27.2
04056500	-1.87	0.28	<1.00E-06	-1.77	1.02	8.63E-02	6.27	1.07	<1.00E-06	2.32	0.54	4.84E-05	76	21.8
04059500	1.17	0.33	5.69E-04	-1.56	0.47	1.16E-03	-2.65	0.86	2.74E-03	-3.11	0.89	7.27E-04	94	22.8
04065722	-1.54	0.35	4.52E-05	0.19	0.53	7.26E-01	-0.03	0.71	9.64E-01	-1.24	0.91	1.78E-01	54	20.7

STAID	$\hat{w}$ (%/dec)	$\hat{w}$ SE (%/dec)	$\hat{w}$ p	$\hat{h}$ (%/dec)	$\hat{h}$ SE (%/dec)	$\hat{h}$ p	$\hat{U}$ (%/dec)	$\hat{U}$ SE (%/dec)	$\hat{U}$ p	$\hat{Q}$ (%/dec)	$\hat{Q}$ SE (%/dec)	$\hat{Q}$ p	N msts	N years
04071858	3.16	0.79	1.51E-04	-2.94	1.84	1.15E-01	-6.17	3.87	1.15E-01	-5.92	3.70	1.14E-01	76	23.9
04072150	1.68	2.72	5.38E-01	-11.97	3.23	3.98E-04	28.19	3.93	<1.00E-06	15.25	3.17	7.67E-06	75	25.2
04073500	-0.04	0.04	3.42E-01	0.07	0.09	4.46E-01	-4.17	0.30	<1.00E-06	-3.68	0.23	1.00E-06	129	53.5
04074950	-0.56	0.16	7.47E-04	-0.27	0.21	2.10E-01	0.10	0.36	7.84E-01	-0.60	0.28	3.34E-02	85	36.5
04079000	-1.53	0.20	<1.00E-06	0.64	0.34	6.44E-02	2.20	0.51	3.66E-05	1.42	0.55	1.12E-02	113	56.5
04085281	-1.49	1.32	2.61E-01	6.64	2.28	4.60E-03	5.85	3.30	7.95E-02	7.15	2.77	1.13E-02	90	23.9
04085427	0.62	0.43	1.49E-01	-4.83	0.91	<1.00E-06	-2.77	1.53	7.36E-02	-7.72	0.87	1.00E-06	110	39.8
04086500	2.30	0.52	2.97E-05	-2.37	0.35	<1.00E-06	-1.65	1.24	1.89E-01	-0.55	0.96	5.65E-01	93	62.2
04086600	1.05	0.38	6.88E-03	6.61	2.10	2.41E-03	-6.78	2.09	1.73E-03	1.00	2.01	6.22E-01	76	28.3
04087000	1.62	0.33	3.14E-06	1.76	0.60	3.92E-03	2.36	0.83	5.54E-03	5.88	0.57	1.00E-06	106	61.1
04087204	7.03	1.45	3.44E-06	6.36	1.68	2.29E-04	-3.57	1.84	5.41E-02	15.05	1.95	1.00E-06	127	42.4
04087220	3.46	0.44	<1.00E-06	-3.53	0.95	2.89E-04	-6.98	1.21	<1.00E-06	-8.03	1.08	1.00E-06	120	48.6
04093000	-6.07	1.62	3.43E-04	0.05	2.16	9.82E-01	-63.13	4.64	<1.00E-06	-81.69	4.12	1.00E-06	81	24.9
04099750	2.13	0.27	<1.00E-06	-2.87	0.75	2.34E-04	-6.11	1.15	<1.00E-06	-8.68	1.15	1.00E-06	81	29.3
04100222	0.52	2.16	8.12E-01	0.13	0.92	8.91E-01	-5.14	2.99	8.90E-02	-4.38	2.53	8.64E-02	86	28.7
04101500	-0.31	0.09	7.06E-04	-1.19	0.18	<1.00E-06	-2.51	0.51	2.52E-06	-3.96	0.59	1.00E-06	124	38.7
04102700	3.83	0.35	<1.00E-06	3.58	0.73	3.21E-06	-7.21	1.21	<1.00E-06	0.53	0.86	5.40E-01	102	27.6
04105000	-2.36	0.59	1.28E-04	-13.71	1.56	<1.00E-06	18.11	1.96	<1.00E-06	-0.30	0.72	6.75E-01	101	22.8
04106300	6.96	0.89	<1.00E-06	1.51	0.94	1.12E-01	-6.27	1.52	7.19E-05	3.34	1.49	2.68E-02	105	22.5
04108600	0.48	1.14	6.77E-01	-11.97	2.04	<1.00E-06	-8.42	3.16	9.04E-03	-22.71	2.97	1.00E-06	101	24.6
04109000	-2.55	0.56	1.61E-05	5.21	2.38	3.10E-02	-9.77	2.19	2.03E-05	-5.48	0.96	1.00E-06	103	22.7
04111379	2.48	1.72	1.56E-01	-7.39	1.99	5.25E-04	0.33	2.52	8.96E-01	-4.65	1.89	1.77E-02	51	29.1
04115265	-3.50	1.55	2.58E-02	3.44	2.25	1.31E-01	16.98	2.31	<1.00E-06	16.75	1.83	1.00E-06	94	25.8
04117500	5.25	1.54	9.47E-04	2.90	1.21	1.87E-02	-1.39	1.42	3.30E-01	4.72	0.76	1.00E-06	98	22.4
04118500	0.27	1.19	8.20E-01	0.15	2.12	9.45E-01	2.17	2.00	2.80E-01	2.26	0.83	7.94E-03	82	20.7
04122100	0.15	0.92	8.70E-01	-2.35	1.58	1.40E-01	3.67	2.52	1.48E-01	1.39	2.35	5.55E-01	91	22.9
04135700	0.82	0.82	3.17E-01	0.42	0.95	6.58E-01	-5.35	0.76	<1.00E-06	-2.83	0.60	3.48E-06	84	26.1
04137500	-1.23	0.36	8.46E-04	-1.16	0.97	2.35E-01	5.30	0.89	<1.00E-06	2.35	0.82	4.69E-03	110	25.5
04142000	1.43	1.18	2.30E-01	-1.19	1.45	4.15E-01	-0.71	1.30	5.87E-01	2.02	0.93	3.27E-02	77	22.8
04148140	-2.23	0.64	7.75E-04	3.16	1.21	1.10E-02	-4.74	2.56	6.79E-02	-4.19	2.02	4.10E-02	83	22.3
04148440	-0.17	0.07	4.16E-02	0.52	0.21	3.40E-02	-2.20	1.53	1.80E-01	-2.62	2.18	2.57E-01	11	36.8
04148500	2.23	0.90	1.50E-02	-10.22	0.80	<1.00E-06	-0.38	1.25	7.61E-01	-7.57	0.91	1.00E-06	88	22.5
04150500	12.93	2.06	<1.00E-06	-2.56	1.52	9.61E-02	1.50	2.44	5.40E-01	10.02	1.85	1.00E-06	65	22.9
04152238	-1.17	0.64	7.02E-02	3.56	1.45	1.66E-02	-7.22	2.02	6.45E-04	-5.47	1.78	2.92E-03	74	21.4
04154000	2.22	0.27	<1.00E-06	1.93	0.40	3.04E-06	2.18	0.51	2.47E-05	6.34	0.51	1.00E-06	267	62.8
04155500	2.57	0.31	<1.00E-06	-2.77	0.85	1.80E-03	-4.70	4.57	3.07E-01	-4.21	4.65	3.68E-01	68	25.5
04159900	-7.73	1.98	2.17E-04	-1.83	4.52	6.87E-01	8.44	8.40	3.18E-01	-5.24	5.01	2.98E-01	73	20.8
04160600	3.95	0.44	<1.00E-06	6.20	1.04	<1.00E-06	-12.41	2.28	<1.00E-06	-3.45	2.09	1.03E-01	86	22.2
04160900	4.14	0.48	<1.00E-06	5.66	1.11	1.67E-06	-6.40	2.17	3.98E-03	2.54	1.64	1.24E-01	98	23.1
04161540	3.42	0.52	<1.00E-06	-0.58	0.78	4.63E-01	-8.87	1.17	<1.00E-06	-4.78	1.06	1.92E-05	97	23.0
04164100	-1.12	1.57	4.76E-01	-7.35	1.96	2.95E-04	-5.02	2.56	5.27E-02	-15.30	4.04	2.64E-04	98	23.0
04166100	-0.04	0.44	9.28E-01	-10.67	0.89	<1.00E-06	-9.23	1.24	<1.00E-06	-19.32	1.33	1.00E-06	225	54.7
04170000	5.30	0.81	<1.00E-06	-1.77	0.89	4.97E-02	-4.89	1.32	3.32E-04	-1.93	1.29	1.38E-01	111	24.4
04170500	-4.19	0.82	1.25E-06	-9.34	0.85	<1.00E-06	2.44	2.35	3.02E-01	-11.35	2.72	6.07E-05	111	27.7
04175600	5.98	1.58	2.71E-04	-11.33	0.89	<1.00E-06	5.69	2.34	1.70E-02	-1.08	1.19	3.64E-01	100	23.9
04178000	1.89	0.53	5.76E-04	-0.96	0.46	3.95E-02	-15.06	1.87	<1.00E-06	-14.39	1.92	1.00E-06	81	29.1
04182000	1.92	0.84	2.53E-02	1.59	1.29	2.19E-01	2.71	2.03	1.84E-01	5.81	0.97	1.00E-06	78	23.5
04185440	33.10	3.72	<1.00E-06	13.22	3.81	1.03E-03	-70.25	8.22	<1.00E-06	-5.16	3.92	1.94E-01	56	21.0
04195500	-2.12	1.65	2.04E-01	19.07	4.61	1.30E-04	-17.08	4.02	8.97E-05	-1.07	2.44	6.63E-01	53	20.5
04207200	7.18	1.05	<1.00E-06	25.50	2.99	<1.00E-06	22.28	3.41	<1.00E-06	51.72	4.08	1.00E-06	57	21.9
04213000	12.53	1.71	<1.00E-06	2.79	1.44	5.73E-02	0.92	1.98	6.45E-01	16.09	2.78	1.00E-06	72	23.3
04224775	5.62	1.13	1.91E-06	5.67	1.85	2.63E-03	33.30	1.96	<1.00E-06	42.68	2.23	1.00E-06	143	34.2
04229500	-3.62	1.73	3.83E-02	2.64	1.39	5.99E-02	18.35	2.06	<1.00E-06	14.69	0.93	1.00E-06	123	35.3
04230380	-0.67	1.50	6.55E-01	31.61	1.31	<1.00E-06	29.71	1.62	<1.00E-06	54.01	1.93	1.00E-06	209	40.8
04230500	-0.48	0.29	9.19E-02	3.90	0.52	<1.00E-06	-5.80	0.54	<1.00E-06	-2.91	0.25	1.00E-06	278	58.8
04231000	1.71	0.44	1.29E-04	-6.95	0.52	<1.00E-06	3.53	0.74	2.85E-06	-1.98	0.51	1.46E-04	269	63.6
04235250	9.54	1.03	<1.00E-06	13.54	1.10	<1.00E-06	4.75	1.28	2.74E-04	26.95	1.12	1.00E-06	170	49.0
04250750	-1.24	0.26	4.57E-06	1.68	0.37	7.70E-06	-2.60	0.49	<1.00E-06	-2.73	0.48	1.00E-06	218	55.7
04258000	0.21	0.05	1.57E-05	0.11	0.10	2.44E-01	-0.86	0.15	<1.00E-06	-0.46	0.16	5.14E-03	106	61.5
04265000	-0.94	0.27	8.32E-04	-1.50	0.39	2.28E-04	6.12	0.57	<1.00E-06	3.14	0.34	1.00E-06	99	27.3
04267500	-0.17	0.24	4.87E-01	-4.13	0.93	3.32E-05	4.79	0.82	<1.00E-06	0.13	0.64	8.45E-01	66	29.2
04270200	-1.60	0.38	5.08E-05	3.77	0.60	<1.00E-06	-10.22	0.92	<1.00E-06	-8.03	0.74	1.00E-06	116	45.5
04271815	-5.04	0.83	<1.00E-06	4.35	2.35	6.80E-02	-8.80	2.48	6.09E-04	-5.25	1.74	3.35E-03	90	40.2
04276842	-1.53	1.18	1.98E-01	-2.60	3.40	4.48E-01	15.32	3.29	1.33E-05	12.98	4.41	4.28E-03	77	21.2
04293000	2.28	2.18	3.00E-01	20.33	3.36	<1.00E-06	-21.04	5.47	3.57E-04	3.25	0.54	1.00E-06	49	21.9
05046000	5.11	0.33	<1.00E-06	-2.75	0.33	<1.00E-06	-2.38	0.45	<1.00E-06	0.36	0.28	1.98E-01	239	54.8
05050000	0.16	1.35	9.05E-01	-4.11	1.10	2.55E-04	10.11	2.34	2.75E-05	7.30	2.81	1.04E-02	161	49.5
05059000	0.52	0.85	5.40E-01	0.11	1.10	9.22E-01	-1.57	1.51	3.01E-01	0.17	1.27	8.94E-01	107	21.6
05061500	-9.96	2.36	5.55E-05	2.37	2.06	2.52E-01	14.74	4.08	4.84E-04	6.31	3.07	4.28E-02	98	30.3
05062500	1.24	0.58	3.46E-02	3.46	0.67	<1.00E-06	-8.05	0.73	<1.00E-06	-3.59	0.81	1.71E-05	152	62.4
05064900	5.24	4.21	2.19E-01	20.99	7.75	9.16E-03	-13.55	7.65	8.23E-02	16.70	5.48	3.64E-03	53	20.7
05076000	-0.36	1.05	7.35E-01	1.66	1.21	1.74E-01	-1.84	1.17	1.18E-01	-0.17	0.66	8.02E-01	127	45.5
05078230	7.00	1.99	7.97E-04	-7.63	2.75	7.27E-03	-15.49	4.01	2.58E-04	-7.92	4.15	6.08E-02	67	23.2
05082500	-1.50	0.38	1.00E-04	8.57	0.77	<1.00E-06	-6.63	1.39	4.30E-06	-0.43	1.22	7.27E-01	171	26.5
05087500	9.11	2.65	8.71E-04	-6.55	3.34	5.26E-02	-10.22	4.84	3.72E-02	-14.45	6.50	2.87E-02	97	29.5
05094000	2.61	1.25	3.79E-02	-0.47	1.42	7.41E-01	-6.22	1.71	3.71E-04	-5.52	1.30	3.80E-05	161	47.2
05101000	19.83	2.61	<1.00E-06	31.65	2.94	<1.00E-06	45.76	5.59	<1.00E-06	103.37	4.09	1.00E-06	105	29.6
05116500	14.32	2.88	2.51E-06	2.90	3.34	3.87E-01	-30.91	4.79	<1.00E-06	-17.76	3.88	1.29E-05	106	26.5
05129115	0.23	0.32	4.70E-01	-0.95	0.31	3.09E-03	0.52	0.50	3.00E-01	-0.36	0.34	2.84E-01	83	30.0
05130500	6.33	1.31	7.80E-06	-0.49	1.68	7.72E-01	-3.47	1.39	1.46E-02	1.80	0.60	3.74E-03	70	32.7
05220500	0.15	0.33	6.51E-01	1.08	0.34	2.01E-03	-0.83	0.17	4.20E-06	0.61	0.19	1.54E-03	137	40.3
05227500	0.02	0.18	9.21E-01	-3.12	0.27	<1.00E-06	2.30	0.42	<1.00E-06	-1.27	0.38	1.26E-03	78	45.4
05242300	1.18	0.37	2.39E-03	0.16	0.59	7.83E-01	2.77	0.84	1.60E-03	3.76	0.82	2.10E-05	64	20.0
05291000	12.23	1.52	<1.00E-06	20.03	1.23	<1.00E-06	9.76	1.67	<1.00E-06	39.95	1.65	1.00E-06	232	58.3
05293000	-2.52	1.27	5.01E-02	8.14	1.59	1.56E-06	1.83	1.39	1.90E-01	4.68	2.53	6.74E-02	97	58.1

STAID	$\hat{w}$ (%/dec)	$\hat{w}$ SE (%/dec)	$\hat{w}$ p	$\hat{h}$ (%/dec)	$\hat{h}$ SE (%/dec)	$\hat{h}$ p	$\hat{U}$ (%/dec)	$\hat{U}$ SE (%/dec)	$\hat{U}$ p	$\hat{Q}$ (%/dec)	$\hat{Q}$ SE (%/dec)	$\hat{Q}$ p	N msts	N years
05315000	9.37	5.57	9.68E-02	-1.42	7.17	8.43E-01	4.12	7.49	5.84E-01	0.31	14.39	9.83E-01	72	20.6
05330000	-2.49	1.45	8.89E-02	2.97	1.39	3.66E-02	7.27	1.65	3.70E-05	5.91	0.77	1.00E-06	71	25.2
05336700	0.83	0.65	2.05E-01	-1.04	0.83	2.17E-01	-3.00	1.05	5.48E-03	-2.92	1.04	5.29E-03	68	25.5
05338500	6.98	1.87	4.36E-04	2.40	2.70	3.76E-01	-5.02	2.73	7.10E-02	5.37	1.61	1.51E-03	60	26.0
05368000	0.96	0.54	7.69E-02	-3.98	0.67	<1.00E-06	-4.27	0.57	<1.00E-06	-7.51	0.75	1.00E-06	100	53.1
05374000	4.05	1.07	4.56E-04	2.18	1.79	2.28E-01	3.19	1.52	4.19E-02	6.92	0.94	1.00E-06	45	42.2
05379400	3.45	1.22	5.80E-03	-8.61	3.96	3.20E-02	4.94	2.98	1.01E-01	0.20	5.49	9.71E-01	105	43.2
05379500	-0.12	0.24	6.20E-01	-13.49	1.45	<1.00E-06	-6.66	0.94	<1.00E-06	-18.15	0.74	1.00E-06	92	45.5
05381000	-0.43	1.02	6.75E-01	1.31	1.03	2.07E-01	3.18	2.00	1.16E-01	2.27	0.63	5.25E-04	74	26.9
05391000	1.87	0.52	6.45E-04	-0.58	0.33	8.39E-02	2.71	1.49	7.40E-02	1.82	1.60	2.60E-01	64	30.5
05404000	0.70	0.08	<1.00E-06	3.02	0.41	<1.00E-06	11.84	0.62	<1.00E-06	15.20	0.69	1.00E-06	114	45.3
05408000	-15.79	1.14	<1.00E-06	3.71	1.31	5.67E-03	0.56	1.55	7.20E-01	-10.69	1.31	1.00E-06	81	22.9
05412500	4.27	0.24	<1.00E-06	-14.96	0.55	<1.00E-06	-4.05	0.47	<1.00E-06	-15.43	0.76	1.00E-06	348	61.7
05413500	3.00	0.88	8.55E-04	10.91	1.79	<1.00E-06	-3.19	2.25	1.58E-01	5.66	0.89	1.00E-06	115	48.2
05414500	7.15	0.66	<1.00E-06	1.09	1.31	4.06E-01	-18.76	1.63	<1.00E-06	-11.50	1.22	1.00E-06	279	31.3
05418500	1.43	0.32	1.40E-05	7.58	0.75	<1.00E-06	-2.75	0.57	2.90E-06	5.25	0.64	1.00E-06	181	40.4
05419000	-0.86	0.51	9.31E-02	-6.70	0.77	<1.00E-06	-2.01	0.56	4.09E-04	-9.24	0.36	1.00E-06	284	62.2
05420560	10.70	1.38	<1.00E-06	1.86	2.12	3.83E-01	-18.10	2.17	<1.00E-06	-7.27	2.46	3.66E-03	139	34.0
05427718	-7.71	1.63	6.99E-06	-4.26	1.81	2.03E-02	-2.23	2.84	4.32E-01	-13.58	2.45	1.00E-06	113	21.6
05431022	9.34	2.33	1.10E-04	11.56	2.16	<1.00E-06	22.22	3.40	<1.00E-06	40.22	5.21	1.00E-06	112	26.0
05437500	0.21	0.28	4.48E-01	-1.37	0.43	2.10E-03	0.78	0.62	2.13E-01	-0.39	0.64	5.40E-01	87	30.2
05440700	0.42	0.68	5.42E-01	-2.93	0.56	4.11E-06	2.95	0.90	1.84E-03	0.88	0.78	2.69E-01	49	29.1
05448000	-5.49	4.19	1.94E-01	-20.92	4.65	3.06E-05	-8.42	6.68	2.13E-01	-37.49	3.50	1.00E-06	63	24.1
05451900	5.15	1.43	4.23E-04	-12.44	1.65	<1.00E-06	-7.52	1.48	<1.00E-06	-13.89	2.67	1.00E-06	177	41.0
05452000	-0.10	0.82	8.99E-01	-9.33	0.84	<1.00E-06	-7.46	0.77	<1.00E-06	-15.50	1.15	1.00E-06	324	62.3
05453000	9.59	1.90	1.61E-06	-7.15	2.15	1.18E-03	-3.95	1.25	1.99E-03	-1.44	2.50	5.66E-01	122	30.6
05454500	-2.40	0.35	<1.00E-06	1.62	0.63	1.04E-02	5.58	0.45	<1.00E-06	4.39	0.38	1.00E-06	209	35.6
05455500	0.40	0.45	3.84E-01	-4.23	0.68	<1.00E-06	-8.69	0.81	<1.00E-06	-11.18	0.93	1.00E-06	337	58.4
05457700	0.73	0.14	<1.00E-06	1.25	0.53	1.96E-02	3.87	0.52	<1.00E-06	7.50	0.62	1.00E-06	207	61.5
05459000	0.22	0.65	7.30E-01	6.03	1.07	<1.00E-06	5.58	1.56	4.63E-04	11.45	1.79	1.00E-06	158	36.4
05463000	0.62	1.16	5.93E-01	-8.60	0.85	<1.00E-06	-2.73	0.76	3.94E-04	-9.74	0.56	1.00E-06	195	50.9
05463500	5.40	0.61	<1.00E-06	5.85	0.88	<1.00E-06	-5.14	0.76	<1.00E-06	5.92	0.89	1.00E-06	231	61.1
05464500	0.71	0.10	<1.00E-06	-0.90	0.49	6.85E-02	-4.08	0.53	<1.00E-06	-4.53	0.25	1.00E-06	302	59.8
05465000	-1.12	0.51	2.99E-02	-0.76	0.53	1.53E-01	0.53	0.38	1.64E-01	-1.19	0.30	7.28E-05	252	49.0
05465500	5.43	1.08	1.26E-06	-4.21	1.23	8.14E-04	-5.04	1.07	4.75E-06	-2.33	0.59	1.09E-04	175	35.5
05466500	-1.98	0.84	2.01E-02	-0.75	1.76	6.69E-01	-10.89	1.62	<1.00E-06	-14.74	1.48	1.00E-06	123	32.4
05469000	-2.20	0.87	1.31E-02	-7.24	1.46	2.81E-06	13.96	1.58	<1.00E-06	4.42	1.29	9.22E-04	100	32.1
05471050	-1.19	0.69	8.67E-02	9.18	1.20	<1.00E-06	-0.32	1.12	7.74E-01	9.98	1.72	1.00E-06	112	28.6
05473400	1.46	0.74	5.15E-02	2.22	1.39	1.13E-01	2.40	1.77	1.77E-01	6.23	1.55	9.26E-05	139	44.5
05473500	-6.75	1.84	3.97E-04	-8.59	3.73	2.35E-02	6.10	4.18	1.48E-01	-5.37	3.56	1.35E-01	95	22.1
05478000	7.21	1.97	3.71E-04	1.83	2.85	5.24E-01	-10.99	2.99	3.58E-04	-2.91	2.63	2.71E-01	117	24.0
05479000	1.69	0.53	1.56E-03	2.39	0.49	1.71E-06	2.90	0.60	1.82E-06	7.57	0.46	1.00E-06	293	56.6
05480000	-7.26	1.97	2.86E-04	-11.28	1.80	<1.00E-06	-3.77	2.16	8.19E-02	-21.74	1.97	1.00E-06	203	31.4
05481000	-0.36	0.38	3.44E-01	0.16	0.33	6.33E-01	2.49	0.51	1.63E-06	2.76	0.51	1.00E-06	324	58.4
05481300	0.40	0.40	3.19E-01	-0.01	0.64	9.85E-01	0.30	0.51	5.53E-01	1.03	0.63	1.07E-01	208	43.6
05482300	4.02	1.65	1.70E-02	-3.35	2.08	1.10E-01	-3.04	1.86	1.06E-01	-0.77	1.16	5.10E-01	84	24.2
05484000	12.12	0.71	<1.00E-06	10.06	1.03	<1.00E-06	-11.11	2.39	1.11E-05	13.81	2.78	3.33E-06	90	24.4
05485640	4.36	1.15	2.17E-04	11.12	1.43	<1.00E-06	-0.72	1.20	5.51E-01	13.19	2.40	1.00E-06	158	41.6
05487500	-6.71	1.38	3.77E-06	-7.30	2.48	4.01E-03	-22.86	3.80	<1.00E-06	-32.04	3.31	1.00E-06	113	25.8
05488200	3.54	5.42	5.15E-01	-1.46	6.10	8.11E-01	2.23	5.46	6.83E-01	2.51	10.35	8.09E-01	99	23.7
05490500	-1.10	0.39	5.36E-03	3.29	0.67	2.18E-06	2.98	0.57	<1.00E-06	4.36	0.42	1.00E-06	169	40.2
05495000	15.12	3.64	7.96E-05	34.84	4.06	<1.00E-06	-10.71	6.81	1.19E-01	38.12	7.31	1.35E-06	83	23.2
05496000	6.98	2.58	8.18E-03	2.63	3.65	4.73E-01	-9.33	3.24	4.98E-03	0.42	2.42	8.63E-01	93	27.2
05497000	-7.11	1.42	2.09E-06	-17.34	1.40	<1.00E-06	-18.52	1.48	<1.00E-06	-38.13	1.57	1.00E-06	107	54.7
05498000	4.89	0.95	<1.00E-06	-0.41	1.29	7.52E-01	-11.30	1.62	<1.00E-06	-6.16	1.70	3.56E-04	269	55.7
05507600	15.04	4.28	7.23E-04	16.09	3.95	1.09E-04	-3.28	5.43	5.47E-01	30.04	5.11	1.00E-06	80	25.2
05515500	-3.23	0.78	1.03E-04	0.34	1.45	8.16E-01	3.37	1.88	7.70E-02	0.62	1.06	5.59E-01	70	29.6
05516500	4.08	1.13	5.18E-04	-1.03	1.45	4.81E-01	-1.24	2.16	5.65E-01	2.80	1.39	4.74E-02	81	25.4
05517000	1.83	1.40	1.96E-01	-0.05	1.97	9.78E-01	-4.49	1.23	4.56E-04	-1.34	0.62	3.37E-02	82	25.6
05517530	-0.46	0.33	1.65E-01	4.45	0.65	<1.00E-06	-7.37	1.13	<1.00E-06	-4.18	0.70	1.00E-06	71	29.6
05524500	-0.17	0.34	6.10E-01	-0.53	0.36	1.42E-01	-2.44	1.44	9.24E-02	-3.18	1.51	3.72E-02	111	57.1
05525000	0.49	0.71	4.92E-01	5.98	0.97	<1.00E-06	-16.04	1.99	<1.00E-06	-6.38	1.64	1.86E-04	103	32.4
05526000	0.76	0.41	6.75E-02	2.95	0.73	9.82E-05	-3.40	1.11	2.96E-03	1.14	0.71	1.13E-01	97	31.3
05529000	6.77	1.22	<1.00E-06	3.14	1.70	6.73E-02	-2.11	1.53	1.70E-01	7.55	1.13	1.00E-06	98	28.8
05532000	2.12	0.73	4.05E-03	2.10	0.83	1.16E-02	-8.18	1.44	<1.00E-06	-2.63	1.80	1.46E-01	251	60.4
05535000	-6.94	3.65	6.04E-02	4.75	3.29	1.52E-01	-11.58	4.51	1.18E-02	-6.77	5.60	2.30E-01	94	27.0
05536290	2.17	0.99	3.04E-02	-7.11	1.34	<1.00E-06	9.08	1.50	<1.00E-06	3.41	1.47	2.24E-02	106	29.0
05536340	13.67	3.65	2.84E-04	3.04	3.02	3.17E-01	-2.62	4.38	5.51E-01	18.56	6.31	3.97E-03	118	30.0
05537500	19.19	2.25	<1.00E-06	3.14	2.38	1.90E-01	-12.37	3.99	2.56E-03	10.62	4.24	1.41E-02	96	27.6
05540130	2.74	0.91	3.73E-03	0.16	1.00	8.72E-01	-5.07	1.66	3.11E-03	-1.25	1.67	4.59E-01	73	21.6
05540195	11.39	5.15	2.96E-02	7.86	3.79	4.11E-02	6.88	6.61	3.01E-01	16.77	6.76	1.51E-02	84	20.1
05540275	-7.72	3.02	1.21E-02	-7.35	3.51	3.88E-02	-13.23	4.87	7.68E-03	-25.62	4.55	1.00E-06	106	24.9
05540500	4.17	0.43	<1.00E-06	0.07	1.74	9.68E-01	-2.12	2.06	3.05E-01	1.21	0.77	1.19E-01	94	28.0
05550500	3.30	1.74	6.02E-02	-1.73	1.75	3.26E-01	-16.48	3.91	4.91E-05	-14.12	4.71	3.30E-03	117	31.0
05551200	-10.18	1.28	<1.00E-06	16.27	1.91	<1.00E-06	9.20	2.60	6.14E-04	16.49	2.21	1.00E-06	98	28.0
05551700	-1.22	1.04	2.41E-01	-4.64	0.99	5.76E-06	-15.73	1.59	<1.00E-06	-20.70	1.63	1.00E-06	170	48.4
05554500	0.64	1.95	7.44E-01	-2.59	2.25	2.53E-01	5.35	2.42	2.98E-02	2.81	0.92	2.81E-03	88	27.5
05559500	-5.39	2.89	6.53E-02	-4.88	2.28	3.46E-02	-14.84	3.97	3.04E-04	-30.66	4.76	1.00E-06	104	47.0
05567500	7.57	3.24	2.16E-02	-1.13	2.13	5.97E-01	-0.66	3.32	8.43E-01	10.55	2.24	9.25E-06	91	26.7
05568000	6.03	3.90	1.26E-01	-0.55	3.42	8.73E-01	7.11	2.86	1.52E-02	15.30	2.55	1.00E-06	78	21.2
05570910	-8.17	1.42	<1.00E-06	-2.60	1.24	3.78E-02	-7.93	2.77	5.00E-03	-11.55	2.42	5.05E-06	124	33.9
05578500	2.69	1.30	4.16E-02	-0.05	2.02	9.82E-01	-9.02	3.16	5.32E-03	-5.66	2.65	3.50E-02	96	32.6
05580000	8.52	1.55	<1.00E-06	12.03	1.53	<1.00E-06	4.20	1.58	9.03E-03	22.90	1.66	1.00E-06	140	40.4
05591550	-12.42	3.90	2.03E-03	-7.52	4.83	1.23E-01	-2.27	5.18	6.63E-01	-26.06	5.36	5.10E-06	87	26.3
05592500	1.77	0.57	2.35E-03	0.61	0.94	5.14E-01	-3.85	1.04	3.23E-04	-1.61	0.69	2.08E-02	136	31.3

STAID	$\hat{w}$ (%/dec)	$\hat{w}$ SE (%/dec)	$\hat{w}$ p	$\hat{b}$ (%/dec)	$\hat{b}$ SE (%/dec)	$\hat{b}$ p	$\hat{U}$ (%/dec)	$\hat{U}$ SE (%/dec)	$\hat{U}$ p	$\hat{Q}$ (%/dec)	$\hat{Q}$ SE (%/dec)	$\hat{Q}$ p	N msts	N years
05592800	6.92	3.05	2.53E-02	-13.89	3.37	7.06E-05	-4.63	3.45	1.82E-01	-12.59	3.84	1.38E-03	118	29.2
05593900	-9.78	3.65	8.57E-03	-2.56	3.44	4.59E-01	28.52	3.97	<1.00E-06	14.01	5.88	1.90E-02	105	48.7
05595200	1.45	1.65	3.80E-01	-7.56	2.17	6.82E-04	-11.65	3.54	1.33E-03	-18.68	2.43	1.00E-06	118	31.4
05600000	-6.44	2.67	1.76E-02	11.24	3.15	5.50E-04	-14.67	4.28	8.74E-04	0.73	1.62	6.54E-01	108	51.6
06038500	1.66	0.39	4.76E-05	-2.64	0.63	5.59E-05	-0.81	0.62	1.98E-01	-1.99	0.21	1.00E-06	95	32.8
06043500	0.72	0.22	1.62E-03	-1.43	0.35	7.45E-05	1.45	0.32	1.47E-05	1.20	0.35	9.47E-04	119	32.0
06061500	3.00	0.69	2.53E-05	13.60	1.27	<1.00E-06	-8.18	1.09	<1.00E-06	7.18	0.54	1.00E-06	143	32.8
06066500	0.17	0.07	1.35E-02	-0.14	0.10	1.56E-01	-7.17	0.69	<1.00E-06	-7.25	0.70	1.00E-06	217	36.7
06076690	-7.04	2.15	1.42E-03	-10.75	1.40	<1.00E-06	-5.89	2.47	1.93E-02	-22.72	1.95	1.00E-06	101	30.3
06078500	-5.35	1.37	7.30E-04	3.06	2.89	3.00E-01	2.48	3.68	5.08E-01	2.48	2.57	3.44E-01	23	39.8
06099000	2.85	1.63	8.39E-02	-7.54	2.54	3.80E-03	-9.92	3.64	7.81E-03	-17.43	2.24	1.00E-06	90	24.1
06109500	0.46	0.09	2.95E-06	-1.15	0.23	5.83E-06	2.15	0.33	<1.00E-06	1.97	0.38	1.40E-06	75	36.4
06177000	1.00	0.19	<1.00E-06	-2.35	0.98	1.85E-02	0.69	0.76	3.69E-01	-2.69	0.96	5.83E-03	106	33.4
06183450	15.88	2.67	<1.00E-06	15.15	4.05	3.51E-04	24.79	5.51	2.39E-05	58.48	5.86	1.00E-06	79	23.0
06186500	-0.37	0.12	3.12E-03	-0.91	0.36	1.31E-02	-2.71	0.47	<1.00E-06	-4.11	0.73	1.00E-06	97	32.7
06191000	-0.12	1.32	9.29E-01	-1.17	1.28	3.62E-01	-4.70	1.19	1.26E-04	-5.49	1.00	1.00E-06	119	29.0
06289000	1.82	0.65	5.62E-03	-8.85	1.43	<1.00E-06	-11.19	1.56	<1.00E-06	-18.78	2.22	1.00E-06	126	30.3
06290000	4.48	1.74	1.14E-02	26.06	3.66	<1.00E-06	-4.50	4.42	3.11E-01	29.07	4.71	1.00E-06	97	26.5
06290500	-1.25	0.45	6.63E-03	-2.08	1.23	9.47E-02	7.95	1.26	<1.00E-06	4.86	0.97	3.01E-06	90	23.1
06295250	-11.37	1.69	<1.00E-06	-4.33	1.89	2.50E-02	10.20	3.48	4.61E-03	-4.67	3.95	2.42E-01	67	26.7
06298000	1.00	0.18	<1.00E-06	-2.15	0.38	<1.00E-06	-3.97	0.28	<1.00E-06	-5.26	0.36	1.00E-06	225	60.0
06311000	1.27	2.13	5.54E-01	10.42	2.46	7.45E-05	1.42	3.18	6.58E-01	11.57	2.54	2.46E-05	64	21.2
06340500	-3.32	1.70	5.33E-02	24.42	3.34	<1.00E-06	11.20	2.72	8.00E-05	27.00	4.02	1.00E-06	99	29.7
06356500	8.77	1.84	8.01E-06	-3.18	4.32	4.64E-01	33.53	3.04	<1.00E-06	42.02	2.20	1.00E-06	83	26.9
06360500	-16.12	3.18	2.03E-06	-30.51	3.06	<1.00E-06	-24.76	3.07	<1.00E-06	-62.79	6.33	1.00E-06	95	26.2
06407500	14.70	3.26	2.66E-05	-5.47	4.00	1.75E-01	-19.67	4.94	1.70E-04	-14.10	1.56	1.00E-06	69	21.1
06410500	6.40	1.06	<1.00E-06	-7.67	1.04	<1.00E-06	-6.69	1.49	1.89E-05	-8.60	1.24	1.00E-06	100	37.3
06428500	-6.19	0.60	<1.00E-06	-4.03	1.03	1.28E-04	-3.53	1.02	6.56E-04	-12.03	0.74	1.00E-06	165	58.4
06430770	7.18	1.53	1.02E-05	0.76	1.29	5.60E-01	-10.86	2.14	2.37E-06	-6.05	1.50	1.21E-04	85	21.4
06437020	-5.70	4.08	1.67E-01	-2.02	4.25	6.37E-01	7.12	5.18	1.74E-01	7.22	2.19	1.61E-03	66	20.4
06445685	5.78	0.87	<1.00E-06	19.21	1.97	<1.00E-06	7.81	2.94	1.01E-02	36.25	3.05	1.00E-06	63	20.7
06446000	-1.47	1.33	2.73E-01	-5.83	2.01	4.79E-03	-5.59	5.02	2.69E-01	-15.05	4.43	1.06E-03	79	24.5
06449500	2.22	1.25	7.84E-02	1.76	1.68	2.99E-01	-1.21	1.58	4.46E-01	2.30	1.88	2.25E-01	101	26.0
06468170	10.12	1.80	<1.00E-06	5.00	2.93	9.21E-02	3.77	2.98	2.10E-01	13.91	2.35	1.00E-06	86	29.2
06470878	-1.71	1.25	1.79E-01	3.28	2.89	2.64E-01	9.32	6.68	1.73E-01	12.72	4.88	1.37E-02	33	29.3
06473000	0.07	0.46	8.79E-01	4.80	0.42	<1.00E-06	9.67	1.29	<1.00E-06	16.87	1.26	1.00E-06	156	29.6
06479000	3.66	2.21	1.12E-01	-2.29	2.52	3.73E-01	12.94	2.63	5.15E-05	11.54	3.09	1.04E-03	25	20.2
06479438	31.96	3.17	<1.00E-06	-17.28	2.52	<1.00E-06	8.70	3.31	1.00E-02	26.66	2.72	1.00E-06	96	27.2
06479525	8.03	2.10	2.37E-04	-2.54	2.00	2.08E-01	3.76	2.31	1.07E-01	6.57	2.94	2.79E-02	93	29.8
06481000	-0.79	0.57	1.63E-01	6.12	1.59	2.06E-04	-5.72	1.77	1.64E-03	-0.61	0.84	4.65E-01	107	29.5
06600500	20.94	0.79	<1.00E-06	17.68	1.04	<1.00E-06	6.51	0.62	<1.00E-06	39.95	1.48	1.00E-06	172	40.4
06607500	2.57	0.22	<1.00E-06	3.55	0.62	<1.00E-06	-1.56	0.60	1.02E-02	4.70	0.93	1.00E-06	257	54.1
06614800	-3.77	2.89	1.96E-01	-11.09	2.81	1.69E-04	-18.19	8.14	2.82E-02	-31.84	11.10	5.25E-03	82	23.3
06625000	-1.09	0.22	2.74E-06	2.53	0.38	<1.00E-06	1.88	0.53	5.36E-04	2.92	0.54	1.00E-06	117	31.5
06632400	-3.72	1.75	3.54E-02	6.85	1.41	3.56E-06	-7.30	1.40	<1.00E-06	-3.55	1.93	6.77E-02	116	27.9
06634620	7.31	4.25	8.91E-02	8.97	3.23	6.67E-03	4.03	2.56	1.19E-01	20.00	6.19	1.70E-03	96	24.0
06692000	-2.82	0.12	<1.00E-06	0.97	0.28	4.21E-04	0.17	0.37	6.49E-01	-1.65	0.43	1.58E-04	725	36.1
06770200	-12.94	1.58	<1.00E-06	3.00	1.99	1.34E-01	1.14	1.03	2.72E-01	-13.85	1.99	1.00E-06	179	30.0
06772000	5.13	1.16	1.66E-05	1.93	0.97	4.72E-02	-1.81	0.96	6.15E-02	5.93	1.67	4.66E-04	204	44.5
06783500	-0.95	0.40	1.78E-02	-9.78	1.09	<1.00E-06	-8.09	0.95	<1.00E-06	-18.99	1.48	1.00E-06	450	41.8
06792000	2.60	0.30	<1.00E-06	-1.27	0.94	1.79E-01	0.63	0.59	2.81E-01	2.46	1.33	6.59E-02	422	41.9
06793000	-6.76	2.78	1.60E-02	-4.59	2.50	6.81E-02	-11.06	2.19	1.15E-06	-19.22	4.50	3.13E-05	178	35.7
06804000	4.34	0.71	<1.00E-06	19.70	0.93	<1.00E-06	8.17	0.60	<1.00E-06	29.01	1.21	1.00E-06	292	48.7
06805500	5.52	0.63	<1.00E-06	7.38	0.83	<1.00E-06	-1.31	0.50	9.15E-03	11.44	0.89	1.00E-06	260	39.7
06807410	0.02	1.32	9.90E-01	-3.54	1.87	6.04E-02	-5.03	1.29	1.63E-04	-9.10	1.94	3.13E-06	112	31.1
06808500	-3.70	0.74	<1.00E-06	3.37	0.74	7.36E-06	-0.11	0.41	7.86E-01	-1.20	0.52	2.12E-02	280	55.1
06811500	12.13	1.09	<1.00E-06	15.42	1.45	<1.00E-06	4.82	1.17	4.96E-05	22.39	2.22	1.00E-06	249	45.3
06813000	-4.91	0.79	<1.00E-06	3.64	0.71	<1.00E-06	5.88	0.56	<1.00E-06	5.48	1.06	1.00E-06	258	62.1
06817700	5.93	1.32	1.70E-05	-10.19	2.29	1.87E-05	-5.93	1.77	1.09E-03	-10.62	2.43	2.60E-05	125	30.7
06824500	-6.32	1.70	2.19E-04	2.01	1.26	1.11E-01	-0.99	0.87	2.56E-01	-5.06	2.29	2.75E-02	529	40.3
06834000	0.67	1.29	6.02E-01	-1.48	1.12	1.88E-01	-3.71	0.83	1.52E-05	-5.90	1.43	5.82E-05	168	30.3
06835000	-9.32	0.54	<1.00E-06	-6.12	0.60	<1.00E-06	-5.85	0.44	<1.00E-06	-18.41	0.86	1.00E-06	449	41.0
06844500	12.18	0.89	<1.00E-06	22.03	0.67	<1.00E-06	12.33	0.58	<1.00E-06	34.64	0.89	1.00E-06	604	56.6
06853500	-6.45	3.66	8.19E-02	26.31	3.60	<1.00E-06	2.18	1.97	2.71E-01	15.42	2.75	1.00E-06	92	20.9
06864050	-32.91	3.87	<1.00E-06	-9.84	4.46	2.99E-02	-13.82	3.74	3.74E-04	-56.96	5.69	1.00E-06	94	20.7
06871000	6.19	6.35	3.33E-01	-0.79	4.11	8.49E-01	8.11	3.51	2.44E-02	6.97	9.37	4.60E-01	63	20.4
06872500	-16.77	3.10	<1.00E-06	-8.83	3.91	2.66E-02	-23.00	3.54	<1.00E-06	-64.60	3.30	1.00E-06	85	21.9
06876700	3.45	1.25	7.01E-03	-6.48	1.41	1.46E-05	2.21	3.61	5.42E-01	-4.11	3.83	2.86E-01	88	25.9
06881000	-6.91	1.56	2.51E-05	-2.93	2.15	1.75E-01	-3.59	1.63	3.00E-02	-11.44	1.83	1.00E-06	102	24.4
06881500	3.34	2.04	1.04E-01	8.35	1.49	<1.00E-06	-0.69	2.07	7.38E-01	11.99	1.91	1.00E-06	158	23.1
06884025	10.49	1.48	<1.00E-06	13.98	1.40	<1.00E-06	2.60	0.92	5.05E-03	30.14	1.68	1.00E-06	195	38.8
06884200	11.76	3.19	3.89E-04	-15.07	4.03	3.35E-04	-9.70	3.58	8.20E-03	-8.17	4.85	9.58E-02	87	24.6
06885500	49.76	3.02	<1.00E-06	2.07	5.31	6.97E-01	23.63	4.29	<1.00E-06	88.42	4.48	1.00E-06	92	22.7
06890100	48.21	3.36	<1.00E-06	53.48	2.80	<1.00E-06	18.10	2.60	<1.00E-06	96.79	5.61	1.00E-06	127	24.5
06901500	-4.77	1.19	9.21E-05	-2.78	0.85	1.24E-03	-11.52	1.00	<1.00E-06	-16.91	2.44	1.00E-06	182	63.4
06903900	-1.25	0.54	2.21E-02	-11.35	1.99	<1.00E-06	29.78	2.59	<1.00E-06	17.00	1.91	1.00E-06	164	38.2
06904010	3.85	0.91	4.05E-05	-6.41	1.28	1.72E-06	-2.63	1.14	2.28E-02	-6.88	1.27	1.00E-06	128	28.9
06905500	3.92	0.48	<1.00E-06	8.00	1.10	<1.00E-06	3.38	0.86	1.21E-04	13.75	0.97	1.00E-06	247	54.5
06906500	1.52	0.78	5.73E-02	-1.78	0.83	3.77E-02	-1.16	1.26	3.62E-01	-1.63	0.70	2.37E-02	45	50.1
06917380	10.89	2.55	5.14E-05	-2.95	3.60	4.15E-01	-8.53	5.02	9.29E-02	4.21	5.02	4.04E-01	86	20.9
06918070	5.56	0.67	<1.00E-06	-3.44	0.52	<1.00E-06	-8.36	2.90	5.06E-03	-7.16	3.04	2.11E-02	77	32.1
06931500	-21.47	7.50	5.35E-03	-10.66	5.42	5.28E-02	8.48	6.94	2.25E-01	-4.20	5.02	4.05E-01	82	24.6
07013000	-1.89	1.33	1.57E-01	4.10	1.96	3.89E-02	14.08	1.89	<1.00E-06	17.81	1.46	1.00E-06	106	28.9
07040100	3.20	0.64	1.50E-06	-0.14	0.81	8.67E-01	-7.96	1.46	<1.00E-06	-7.07	1.13	1.00E-06	157	28.0
07040450	-3.46	2.73	2.09E-01	7.76	2.40	1.77E-03	-1.21	2.10	5.66E-01	4.14	2.00	4.16E-02	80	27.5

STAID	$\hat{w}$ (%/dec)	$\hat{w}$ SE (%/dec)	$\hat{w}$ p	$\hat{h}$ (%/dec)	$\hat{h}$ SE (%/dec)	$\hat{h}$ p	$\hat{U}$ (%/dec)	$\hat{U}$ SE (%/dec)	$\hat{U}$ p	$\hat{Q}$ (%/dec)	$\hat{Q}$ SE (%/dec)	$\hat{Q}$ p	N msts	N years
07052250	0.56	0.56	3.27E-01	5.92	0.62	<1.00E-06	-9.93	0.98	<1.00E-06	-2.91	0.74	1.52E-04	106	43.9
07052500	-0.10	0.83	9.06E-01	-11.59	0.83	<1.00E-06	-7.76	1.00	<1.00E-06	-18.98	1.11	1.00E-06	151	54.4
07060500	-1.06	0.08	<1.00E-06	1.46	0.22	<1.00E-06	-0.65	0.25	1.21E-02	-0.58	0.23	1.09E-02	158	46.7
07060710	16.07	1.23	<1.00E-06	11.74	1.66	<1.00E-06	8.31	2.27	3.34E-04	32.06	2.22	1.00E-06	180	46.9
07076750	0.05	0.25	8.55E-01	1.68	0.74	2.78E-02	0.88	0.95	3.57E-01	2.95	0.73	2.02E-04	49	29.4
07094500	-0.83	0.29	5.77E-03	3.15	0.59	<1.00E-06	2.94	0.56	<1.00E-06	5.22	0.55	1.00E-06	111	23.8
07126300	1.05	0.54	5.22E-02	7.51	1.10	<1.00E-06	-12.61	0.96	<1.00E-06	-3.33	0.95	5.01E-04	134	23.7
07141900	6.70	2.20	3.13E-03	11.88	3.09	2.39E-04	5.66	4.47	2.10E-01	23.79	6.71	5.52E-04	83	20.9
07143300	-8.30	3.82	3.24E-02	-23.74	2.66	<1.00E-06	-4.79	5.83	4.13E-01	-35.16	4.92	1.00E-06	86	21.0
07143665	37.07	2.77	<1.00E-06	50.19	3.37	<1.00E-06	0.13	3.31	9.69E-01	85.07	3.61	1.00E-06	99	24.4
07144200	7.67	1.31	<1.00E-06	24.20	2.18	<1.00E-06	0.46	2.53	8.56E-01	31.67	2.68	1.00E-06	93	26.1
07144550	11.24	2.39	9.33E-06	19.63	2.85	<1.00E-06	5.95	1.65	5.28E-04	30.00	3.31	1.00E-06	91	25.9
07147070	-14.99	1.60	<1.00E-06	9.77	2.53	1.96E-04	11.31	3.86	4.23E-03	5.79	3.91	1.42E-01	102	26.3
07153000	7.10	4.08	8.54E-02	19.20	3.85	3.09E-06	13.67	4.45	2.83E-03	36.56	3.15	1.00E-06	89	25.0
07175500	4.63	1.08	4.13E-05	6.18	1.82	9.61E-04	6.45	2.51	1.16E-02	14.66	3.76	1.74E-04	104	27.3
07185095	4.50	2.93	1.30E-01	-13.28	3.61	5.06E-04	-5.15	5.20	3.26E-01	-13.42	4.18	2.14E-03	60	28.0
07186000	2.71	0.35	<1.00E-06	3.73	0.45	<1.00E-06	-3.23	0.65	1.91E-06	3.92	0.59	1.00E-06	175	63.7
07195800	3.15	1.13	5.83E-03	5.90	1.10	<1.00E-06	-4.56	1.61	5.02E-03	1.96	2.25	3.84E-01	206	50.7
07197000	0.34	3.22	9.17E-01	-3.90	4.15	3.50E-01	-1.87	4.21	6.57E-01	2.02	4.81	5.76E-01	83	24.0
07215500	-3.38	1.88	7.41E-02	8.25	2.82	4.09E-03	-1.97	3.50	5.74E-01	2.68	1.81	1.42E-01	116	27.2
07229200	-1.64	9.02	8.56E-01	0.30	6.80	9.65E-01	-2.31	6.28	7.15E-01	-0.96	19.10	9.60E-01	53	26.3
07237500	5.52	1.73	1.87E-03	5.61	1.61	7.34E-04	6.69	1.19	<1.00E-06	15.69	1.72	1.00E-06	106	28.6
07238000	5.31	1.07	3.35E-06	-7.92	1.25	<1.00E-06	-4.09	1.13	4.64E-04	-8.04	1.26	1.00E-06	93	28.0
07239300	6.61	2.34	5.93E-03	13.43	2.47	<1.00E-06	6.40	1.84	7.93E-04	22.36	3.61	1.00E-06	90	29.4
07239500	5.37	1.64	1.60E-03	28.24	3.16	<1.00E-06	18.33	2.45	<1.00E-06	43.17	5.43	1.00E-06	79	23.9
07239700	5.69	4.14	1.76E-01	2.61	4.76	5.85E-01	-6.12	3.67	1.03E-01	3.50	7.30	5.34E-01	47	24.5
07241520	24.06	4.22	<1.00E-06	16.01	7.90	4.68E-02	3.41	6.30	5.91E-01	54.64	5.90	1.00E-06	64	20.4
07251500	12.13	1.52	<1.00E-06	3.63	0.92	1.07E-04	14.82	1.13	<1.00E-06	18.60	1.52	1.00E-06	205	58.0
07263000	-15.03	5.25	5.99E-03	-10.46	3.72	6.86E-03	-19.82	7.69	1.28E-02	-41.58	4.55	1.00E-06	54	24.3
07264000	2.43	0.39	<1.00E-06	0.68	0.44	1.19E-01	-11.05	1.17	<1.00E-06	-6.67	1.14	1.00E-06	254	57.6
07268000	1.12	0.59	6.07E-02	-17.89	2.82	<1.00E-06	13.68	2.60	<1.00E-06	-3.85	2.90	1.87E-01	128	30.3
07274000	7.03	1.43	2.66E-06	1.75	1.82	3.41E-01	1.80	0.95	6.11E-02	13.29	2.39	1.00E-06	131	30.8
07301410	6.35	2.55	1.46E-02	7.74	3.48	2.89E-02	-15.68	5.06	2.61E-03	-6.10	7.82	4.38E-01	86	26.6
07301420	2.51	3.98	5.31E-01	30.50	2.64	<1.00E-06	16.61	1.98	<1.00E-06	41.97	5.01	1.00E-06	85	21.9
07312200	12.73	5.21	1.62E-02	12.87	4.73	7.74E-03	1.80	5.50	7.44E-01	17.13	7.95	3.36E-02	101	27.7
07312500	-0.18	2.14	9.32E-01	-4.60	2.30	4.83E-02	0.75	3.67	8.38E-01	0.85	2.63	7.47E-01	104	26.5
07325000	5.45	2.09	1.06E-02	-0.26	2.08	9.02E-01	-0.49	2.07	8.13E-01	4.91	2.21	2.84E-02	92	25.4
07325800	15.86	3.08	1.51E-06	13.58	4.59	3.97E-03	16.91	2.97	<1.00E-06	46.74	6.06	1.00E-06	92	23.4
07337000	0.99	0.69	1.59E-01	12.04	2.12	<1.00E-06	28.36	3.06	<1.00E-06	33.57	3.58	1.00E-06	99	28.4
07340000	-1.82	0.32	<1.00E-06	-0.77	0.44	8.72E-02	5.99	0.40	<1.00E-06	3.62	0.37	1.00E-06	127	44.7
07362100	7.60	3.67	4.35E-02	10.00	4.28	2.37E-02	-13.18	5.50	2.06E-02	1.93	1.88	3.11E-01	49	21.0
07362500	5.06	0.84	<1.00E-06	5.09	0.99	<1.00E-06	-15.85	1.79	<1.00E-06	-7.49	1.51	1.98E-06	137	60.8
08013500	4.46	2.70	1.03E-01	7.92	3.83	4.19E-02	0.81	2.28	7.24E-01	10.83	4.51	1.86E-02	79	29.1
08017300	-8.28	5.81	1.61E-01	-21.07	6.76	3.00E-03	-16.20	9.77	1.03E-01	-57.19	14.44	2.28E-04	53	22.7
08022040	1.31	1.97	5.09E-01	10.24	1.42	<1.00E-06	-2.39	2.28	2.97E-01	6.85	1.54	2.85E-05	81	24.3
08023400	8.77	2.73	2.07E-03	-5.35	3.44	1.25E-01	-27.68	6.40	5.29E-05	-26.64	8.18	1.77E-03	67	30.2
08025500	-1.56	3.43	6.51E-01	-0.63	4.43	8.87E-01	10.60	5.97	8.23E-02	11.18	4.89	2.67E-02	49	26.2
08026000	-1.52	2.26	5.03E-01	6.66	3.41	5.63E-02	4.77	5.59	3.97E-01	12.38	3.60	1.19E-03	51	23.8
08029500	0.68	0.64	2.90E-01	0.23	0.77	7.62E-01	-4.84	0.87	<1.00E-06	-5.34	0.54	1.00E-06	202	59.9
08033300	2.38	6.15	7.00E-01	0.03	5.50	9.96E-01	-13.03	4.90	9.87E-03	-13.89	7.43	5.60E-02	67	22.2
08034500	-4.37	1.25	5.86E-04	3.55	0.79	1.36E-05	0.56	1.01	5.79E-01	0.37	0.83	5.60E-01	156	59.7
08038000	0.01	1.42	9.94E-01	11.07	1.05	<1.00E-06	-7.64	2.17	5.87E-04	2.72	0.73	2.68E-04	141	48.4
08039100	-1.87	1.02	6.94E-02	5.90	1.15	1.20E-06	2.78	1.94	1.53E-01	9.32	1.89	3.00E-06	114	51.4
08057410	7.59	0.30	<1.00E-06	0.57	0.81	4.80E-01	-0.18	0.99	8.54E-01	3.80	0.80	4.19E-06	210	51.4
08064100	-3.86	2.86	1.81E-01	1.38	2.33	5.56E-01	-18.94	5.73	1.44E-03	-25.13	4.25	1.00E-06	77	24.4
08065350	0.45	1.48	7.63E-01	5.36	2.21	1.77E-02	-8.84	1.91	1.48E-05	-5.15	1.71	3.48E-03	80	26.3
08066300	3.97	1.05	2.18E-04	-9.37	1.33	<1.00E-06	-6.00	0.95	<1.00E-06	-9.09	0.89	1.00E-06	166	45.8
08067650	0.56	2.62	8.32E-01	-12.28	3.18	1.80E-04	-5.10	4.54	2.64E-01	-17.94	4.99	4.73E-04	122	38.7
08068000	6.07	1.60	2.11E-04	22.56	2.40	<1.00E-06	1.54	2.21	4.87E-01	23.78	3.30	1.00E-06	187	46.8
08068090	2.12	2.61	4.19E-01	30.97	4.34	<1.00E-06	10.80	2.35	1.51E-05	37.20	5.10	1.00E-06	83	24.3
08068740	1.23	2.15	5.69E-01	-1.69	2.52	5.04E-01	-15.31	2.48	<1.00E-06	-13.89	4.61	3.08E-03	137	32.9
08070200	15.65	1.64	<1.00E-06	38.76	2.61	<1.00E-06	-8.17	3.75	3.20E-02	54.00	2.35	1.00E-06	89	24.5
08070500	-0.74	1.98	7.09E-01	-1.61	2.19	4.64E-01	1.46	2.22	5.13E-01	-3.76	1.81	3.97E-02	103	28.6
08071280	-6.24	3.63	9.00E-02	5.96	5.48	2.80E-01	-43.04	5.61	<1.00E-06	-40.01	6.35	1.00E-06	76	24.2
08084000	-18.84	5.31	6.68E-04	1.26	3.13	6.89E-01	6.35	6.02	2.95E-01	-17.57	6.23	5.14E-03	78	22.5
08086290	5.90	14.24	6.80E-01	-5.03	8.46	5.55E-01	-29.89	8.75	1.20E-03	-18.67	15.33	2.29E-01	56	31.6
08095200	2.30	2.01	2.55E-01	-7.92	2.09	2.23E-04	-2.90	1.89	1.28E-01	-1.25	3.60	7.28E-01	154	53.3
08104100	2.34	1.39	9.47E-02	-0.12	1.40	9.31E-01	-2.40	1.94	2.18E-01	0.16	2.11	9.38E-01	122	49.9
08104500	7.05	0.78	<1.00E-06	20.52	1.09	<1.00E-06	0.05	1.32	9.69E-01	24.52	1.53	1.00E-06	189	50.9
08108700	0.29	0.53	5.87E-01	4.74	1.14	9.99E-05	3.83	2.80	1.75E-01	9.60	2.66	5.07E-04	65	20.2
08110100	28.18	2.33	<1.00E-06	13.78	2.63	<1.00E-06	-7.93	3.80	3.92E-02	28.38	3.78	1.00E-06	110	32.4
08110430	53.51	3.61	<1.00E-06	38.93	3.64	<1.00E-06	6.44	4.38	1.44E-01	77.41	5.02	1.00E-06	100	28.5
08110500	10.03	1.24	<1.00E-06	13.16	1.88	<1.00E-06	16.47	2.54	<1.00E-06	33.93	3.57	1.00E-06	123	32.3
08111700	32.27	1.98	<1.00E-06	24.91	2.23	<1.00E-06	15.23	1.64	<1.00E-06	62.56	2.60	1.00E-06	148	42.1
08114000	-5.49	1.83	3.55E-03	10.88	2.44	2.77E-05	34.00	3.11	<1.00E-06	36.72	3.27	1.00E-06	80	23.1
08116650	-6.32	0.67	<1.00E-06	14.65	0.97	<1.00E-06	6.82	1.12	<1.00E-06	16.15	1.07	1.00E-06	164	46.6
08123850	8.18	3.57	2.48E-02	34.04	3.83	<1.00E-06	-43.61	6.90	<1.00E-06	-10.15	3.34	3.25E-03	77	20.2
08164000	-1.90	0.51	2.58E-04	-32.33	1.58	<1.00E-06	-13.99	1.31	<1.00E-06	-43.61	2.01	1.00E-06	196	50.4
08164300	-2.82	0.83	8.44E-04	-18.28	1.36	<1.00E-06	-12.25	1.24	<1.00E-06	-28.99	1.86	1.00E-06	209	49.2
08164450	3.19	2.74	2.48E-01	6.18	2.60	1.91E-02	4.68	1.81	1.07E-02	15.38	4.00	1.87E-04	133	34.3
08164500	-3.22	1.63	4.95E-02	-25.38	2.08	<1.00E-06	-14.74	1.90	<1.00E-06	-40.05	2.21	1.00E-06	181	30.2
08180800	9.77	1.65	<1.00E-06	5.92	2.08	5.08E-03	-6.51	2.48	9.66E-03	6.79	1.70	1.12E-04	129	33.2
08188500	3.19	0.20	<1.00E-06	-2.72	0.49	<1.00E-06	-0.82	0.52	1.18E-01	-1.69	0.50	3.22E-04	290	63.6
08189200	10.23	2.35	3.49E-05	12.13	2.50	5.00E-06	4.08	3.73	2.78E-01	31.41	2.52	1.00E-06	90	45.1
08321500	-3.17	1.42	3.07E-02	-1.34	3.38	6.93E-01	-14.67	2.45	<1.00E-06	-11.13	1.47	1.00E-06	44	29.4

STAID	$\hat{w}$ (%/dec)	$\hat{w}$ SE (%/dec)	$\hat{w}$ p	$\hat{b}$ (%/dec)	$\hat{b}$ SE (%/dec)	$\hat{b}$ p	$\hat{U}$ (%/dec)	$\hat{U}$ SE (%/dec)	$\hat{U}$ p	$\hat{Q}$ (%/dec)	$\hat{Q}$ SE (%/dec)	$\hat{Q}$ p	N msts	N years
08329928	5.90	1.59	4.43E-04	-0.25	2.81	9.29E-01	0.14	1.89	9.43E-01	3.44	5.38	5.25E-01	65	22.2
08340500	6.86	3.16	3.93E-02	0.79	1.73	6.52E-01	2.55	2.45	3.08E-01	12.28	3.00	3.87E-04	26	43.9
08396500	-11.75	1.41	<1.00E-06	-12.73	1.82	<1.00E-06	-13.36	1.45	<1.00E-06	-35.80	2.03	1.00E-06	161	23.6
09034900	-2.78	1.41	5.35E-02	-1.64	1.95	4.05E-01	-0.97	1.60	5.48E-01	-7.01	1.47	1.01E-05	69	24.1
09035500	3.85	2.70	1.60E-01	2.91	1.89	1.29E-01	-3.73	2.05	7.36E-02	2.02	3.26	5.38E-01	60	26.7
09051050	-5.00	2.77	7.45E-02	-15.19	2.47	<1.00E-06	8.52	3.34	1.26E-02	-13.72	4.53	3.27E-03	87	22.3
09057500	0.39	0.58	4.99E-01	-2.09	0.51	7.45E-05	-1.24	0.73	9.14E-02	-2.88	0.54	1.00E-06	103	24.2
09058000	-0.14	0.35	6.94E-01	-0.47	2.83	8.68E-01	0.02	3.07	9.95E-01	-0.78	0.66	2.41E-01	90	27.2
09059500	6.31	1.85	1.05E-03	18.69	1.79	<1.00E-06	6.77	2.99	2.65E-02	38.52	3.90	1.00E-06	72	23.7
09063000	-7.72	1.45	<1.00E-06	8.99	1.84	5.05E-06	17.62	2.08	<1.00E-06	18.32	2.42	1.00E-06	83	24.0
09064000	-12.24	1.90	<1.00E-06	14.29	2.74	1.63E-06	-8.20	2.44	1.26E-03	-5.50	1.44	2.89E-04	74	22.9
09065100	-6.93	1.27	<1.00E-06	2.00	1.66	2.32E-01	-2.93	1.51	5.56E-02	-7.70	1.04	1.00E-06	85	24.9
09081600	-1.04	0.38	7.24E-03	13.73	0.88	<1.00E-06	13.71	0.77	<1.00E-06	29.58	1.09	1.00E-06	124	24.6
09089500	18.92	3.48	<1.00E-06	0.00	2.93	9.99E-01	3.86	2.93	1.91E-01	24.26	3.51	1.00E-06	79	20.8
09107000	3.46	1.06	1.73E-03	0.41	1.45	7.78E-01	8.97	1.51	<1.00E-06	12.77	1.86	1.00E-06	67	23.6
09112500	0.57	0.48	2.38E-01	0.32	1.11	7.75E-01	1.25	1.35	3.58E-01	0.32	1.68	8.49E-01	102	23.9
09114500	0.00	0.22	9.94E-01	-7.57	0.79	<1.00E-06	-3.52	0.91	2.08E-04	-10.65	1.38	1.00E-06	95	24.0
09132500	1.36	0.32	4.90E-05	1.54	1.04	1.40E-01	23.32	1.41	<1.00E-06	26.96	1.80	1.00E-06	103	23.8
09152500	-2.57	0.36	<1.00E-06	2.86	0.41	<1.00E-06	5.43	0.54	<1.00E-06	5.83	0.46	1.00E-06	121	28.7
09165000	-4.96	1.02	5.52E-06	1.89	1.08	8.27E-02	11.29	1.22	<1.00E-06	9.07	1.72	1.04E-06	81	23.9
09196500	-5.97	1.31	1.79E-05	11.84	1.78	<1.00E-06	9.77	1.59	<1.00E-06	14.16	1.83	1.00E-06	87	29.6
09210500	8.72	2.15	1.11E-04	-12.38	2.20	<1.00E-06	13.56	2.52	<1.00E-06	9.33	2.47	2.90E-04	89	26.3
09211200	0.30	0.13	2.47E-02	-4.23	0.32	<1.00E-06	-4.93	0.98	1.32E-06	-8.61	0.88	1.00E-06	141	25.8
09217000	2.66	0.78	8.97E-04	3.87	0.66	<1.00E-06	5.66	0.71	<1.00E-06	12.06	0.78	1.00E-06	101	27.0
09220000	-4.72	1.54	5.37E-03	8.94	2.45	1.29E-03	-29.87	2.03	<1.00E-06	-24.57	1.66	1.00E-06	25	25.1
09261700	2.06	0.58	5.87E-04	7.54	1.06	<1.00E-06	19.30	1.20	<1.00E-06	28.28	1.00	1.00E-06	125	28.8
09288000	-12.31	0.84	<1.00E-06	-6.62	1.24	<1.00E-06	6.12	1.21	1.52E-06	-15.68	1.37	1.00E-06	116	26.6
09288180	-13.35	1.26	<1.00E-06	-8.95	1.76	1.47E-06	-20.25	1.76	<1.00E-06	-45.73	2.85	1.00E-06	117	27.5
09291000	1.15	0.48	1.97E-02	-0.65	1.19	5.87E-01	1.66	1.22	1.79E-01	2.18	1.19	7.08E-02	64	30.9
09304200	-2.92	0.76	1.88E-04	0.64	1.33	6.33E-01	-8.44	0.84	<1.00E-06	-11.43	0.59	1.00E-06	124	28.4
09337500	5.49	2.74	4.76E-02	16.93	2.37	<1.00E-06	22.78	2.58	<1.00E-06	44.35	5.28	1.00E-06	117	27.5
09363500	2.04	0.45	1.67E-05	-12.15	1.72	<1.00E-06	-12.35	2.86	3.31E-05	-24.10	4.39	1.00E-06	123	24.0
09372000	0.19	1.01	8.54E-01	8.78	2.39	3.68E-04	-17.03	1.99	<1.00E-06	-5.57	0.89	1.00E-06	105	27.0
09378630	-6.47	3.64	8.46E-02	-27.79	3.48	<1.00E-06	25.59	4.46	1.89E-06	-3.32	4.47	4.63E-01	35	27.1
09394500	-8.48	4.12	4.15E-02	-13.53	2.75	2.47E-06	-15.35	3.66	4.94E-05	-58.70	4.26	1.00E-06	134	24.5
09408400	-3.43	1.01	9.44E-04	1.20	2.54	6.38E-01	6.07	2.46	1.53E-02	-4.62	1.34	3.18E-04	106	27.8
09494000	-0.37	0.99	7.10E-01	-2.59	2.48	2.99E-01	-8.39	3.72	2.66E-02	-12.56	4.08	2.80E-03	83	24.9
10016900	4.11	1.76	2.14E-02	-15.06	1.90	<1.00E-06	4.63	2.26	4.35E-02	-7.36	1.24	1.00E-06	88	23.9
10038000	-8.05	1.29	<1.00E-06	18.49	1.61	<1.00E-06	-3.74	1.52	1.59E-02	1.90	1.06	7.75E-02	99	28.8
10126000	1.59	0.08	<1.00E-06	-0.93	0.18	<1.00E-06	-2.62	0.73	3.92E-04	-2.28	0.73	2.08E-03	187	57.2
10130500	-4.64	0.50	<1.00E-06	-3.78	1.01	2.86E-04	-8.22	0.94	<1.00E-06	-16.01	1.16	1.00E-06	128	36.5
10137500	-0.04	1.10	9.69E-01	0.96	1.24	4.38E-01	-2.27	1.04	3.13E-02	-2.23	1.10	4.45E-02	107	24.0
10163000	-4.28	0.67	<1.00E-06	-3.51	1.37	1.16E-02	4.76	1.64	4.37E-03	-4.74	1.83	1.09E-02	116	24.4
10172700	-10.21	1.71	<1.00E-06	-1.45	2.72	5.96E-01	-12.61	2.32	<1.00E-06	-28.45	2.64	1.00E-06	108	27.4
10234500	-0.95	1.14	4.05E-01	-17.61	1.70	<1.00E-06	-20.99	2.76	<1.00E-06	-36.32	2.84	1.00E-06	99	22.4
10244950	-18.68	1.50	<1.00E-06	0.72	1.37	6.01E-01	-9.05	2.52	5.12E-04	-30.24	1.84	1.00E-06	104	25.3
10249300	7.17	0.99	<1.00E-06	-0.98	1.40	4.85E-01	-7.54	1.95	1.48E-04	-3.60	2.64	1.74E-01	208	46.2
10265150	-0.10	0.14	4.62E-01	2.40	0.40	<1.00E-06	2.24	0.69	1.60E-03	4.67	0.55	1.00E-06	87	27.4
10289500	1.54	0.37	5.63E-05	4.91	0.65	<1.00E-06	11.03	0.91	<1.00E-06	18.04	1.13	1.00E-06	134	56.3
10290500	6.39	0.43	<1.00E-06	0.17	0.46	7.12E-01	0.88	0.48	6.50E-02	8.04	0.32	1.00E-06	201	56.5
10310400	-6.04	1.43	4.88E-05	7.81	2.30	9.38E-04	6.70	1.99	1.03E-03	8.53	1.67	1.38E-06	111	39.5
10311090	-0.36	0.45	4.26E-01	0.06	1.26	9.60E-01	-14.49	3.65	1.29E-04	-17.55	3.49	1.97E-06	107	21.4
10311400	0.91	2.06	6.62E-01	15.26	2.14	<1.00E-06	6.59	2.84	2.20E-02	28.38	3.30	1.00E-06	126	27.5
10324500	-11.31	4.91	2.42E-02	12.85	4.92	1.09E-02	-4.47	6.41	4.88E-01	-4.22	2.77	1.32E-01	74	28.1
10325500	10.15	1.89	<1.00E-06	14.74	2.28	<1.00E-06	-9.05	2.34	1.59E-04	12.43	1.47	1.00E-06	154	29.3
10336698	-3.38	1.52	2.78E-02	10.43	2.32	1.51E-05	-11.75	3.31	5.32E-04	-6.26	2.44	1.12E-02	137	33.8
10336700	-1.69	1.92	3.82E-01	9.08	3.55	1.18E-02	-15.67	3.59	2.79E-05	-10.03	1.41	1.00E-06	116	20.4
10344500	2.94	1.32	2.78E-02	7.49	1.81	6.31E-05	2.51	1.68	1.36E-01	11.14	1.63	1.00E-06	135	46.2
10347460	-0.07	0.60	9.13E-01	11.02	2.20	2.30E-06	-7.88	1.77	2.18E-05	2.97	0.67	2.12E-05	100	20.4
10353750	-11.49	1.90	<1.00E-06	-4.18	2.39	8.40E-02	-18.57	3.85	6.21E-06	-32.99	4.12	1.00E-06	87	20.7
11119500	12.95	4.29	3.24E-03	17.09	3.64	8.82E-06	-7.89	5.54	1.57E-01	11.33	4.35	1.06E-02	95	29.3
11160020	9.86	4.23	2.13E-02	-8.39	3.57	2.02E-02	-7.40	5.51	1.81E-01	1.62	6.29	7.97E-01	138	23.8
11160500	2.47	0.81	2.51E-03	-3.92	1.19	1.16E-03	-24.62	1.42	<1.00E-06	-26.06	1.57	1.00E-06	244	39.5
11169000	2.33	1.94	2.31E-01	7.56	1.55	2.00E-06	-10.88	1.98	<1.00E-06	-1.67	0.75	2.62E-02	213	44.3
11169500	0.14	2.66	9.57E-01	7.69	1.61	2.93E-06	-1.03	2.30	6.55E-01	4.56	4.24	2.83E-01	242	39.5
11169800	2.36	3.33	4.81E-01	4.95	2.41	4.34E-02	12.36	2.74	2.37E-05	22.50	3.69	1.00E-06	74	37.3
11242400	-22.47	4.68	6.59E-06	18.64	2.79	<1.00E-06	39.79	4.33	<1.00E-06	32.07	3.13	1.00E-06	87	20.6
11303000	1.02	0.60	9.30E-02	-6.89	1.69	9.51E-05	-4.90	1.88	1.06E-02	-11.46	0.93	1.00E-06	92	24.3
11348500	-0.58	0.58	3.22E-01	2.57	2.74	3.50E-01	-5.17	2.55	4.62E-02	-2.83	1.33	3.72E-02	70	20.0
11355010	1.42	0.30	1.00E-05	-1.67	0.51	1.76E-03	4.01	0.50	<1.00E-06	3.54	0.52	1.00E-06	72	25.3
11371000	0.55	1.00	5.83E-01	2.77	1.54	7.72E-02	1.81	1.61	2.64E-01	4.59	1.45	2.44E-03	63	31.5
11377100	0.75	0.11	<1.00E-06	1.65	0.33	1.55E-06	0.29	0.34	3.94E-01	2.78	0.30	1.00E-06	141	23.9
11390500	0.91	0.40	2.52E-02	2.09	0.53	1.73E-04	-3.85	0.50	<1.00E-06	-0.80	0.49	1.09E-01	90	25.6
11425500	1.92	0.25	<1.00E-06	3.93	0.76	1.35E-06	-4.12	0.90	1.34E-05	1.80	0.46	1.46E-04	100	25.4
11449500	2.18	3.66	5.53E-01	-28.76	4.08	<1.00E-06	19.14	6.47	3.96E-03	0.88	2.86	7.59E-01	88	21.0
11460750	6.96	4.11	9.38E-02	-4.31	3.45	2.15E-01	-6.49	5.39	2.32E-01	-5.65	2.92	5.63E-02	90	21.6
11468500	-0.13	3.00	9.66E-01	8.38	3.75	2.79E-02	28.13	6.64	5.32E-05	32.93	6.04	1.00E-06	93	23.4
11510700	-0.26	0.19	1.82E-01	0.45	0.23	5.15E-02	0.23	0.22	2.98E-01	0.26	0.20	1.90E-01	94	38.0
11519500	-1.48	0.73	4.28E-02	7.37	1.34	<1.00E-06	4.87	1.48	1.28E-03	7.17	1.60	1.50E-05	141	22.2
11521500	0.49	0.48	3.00E-01	-3.89	0.87	1.68E-05	-0.65	0.83	4.36E-01	-3.24	0.89	3.77E-04	125	42.4
11527000	-2.70	0.31	<1.00E-06	7.96	0.68	<1.00E-06	-1.86	0.76	1.57E-02	5.95	0.66	1.00E-06	125	32.5
11530000	5.97	0.60	<1.00E-06	6.78	0.94	<1.00E-06	3.25	0.74	1.95E-05	15.68	0.80	1.00E-06	140	32.7
12026150	8.99	2.26	1.65E-04	-10.08	3.23	2.59E-03	-18.18	2.73	<1.00E-06	-22.29	4.37	2.51E-06	75	26.1
12027500	1.42	0.37	2.81E-04	5.38	1.28	7.51E-05	-7.95	1.80	3.59E-05	1.20	1.46	4.17E-01	73	57.0
12037400	-0.58	0.34	9.49E-02	1.04	0.95	2.73E-01	-13.16	1.04	<1.00E-06	-13.84	0.98	1.00E-06	80	29.3

STAID	$\hat{w}$ (%/dec)	$\hat{w}$ SE (%/dec)	$\hat{w}$ p	$\hat{h}$ (%/dec)	$\hat{h}$ SE (%/dec)	$\hat{h}$ p	$\hat{U}$ (%/dec)	$\hat{U}$ SE (%/dec)	$\hat{U}$ p	$\hat{Q}$ (%/dec)	$\hat{Q}$ SE (%/dec)	$\hat{Q}$ p	N msts	N years
12045500	-0.81	1.22	5.10E-01	10.84	1.73	<1.00E-06	-25.27	2.07	<1.00E-06	-19.43	1.79	1.00E-06	63	21.4
12054000	0.53	0.87	5.41E-01	15.89	1.88	<1.00E-06	17.87	1.52	<1.00E-06	35.32	1.57	1.00E-06	66	21.5
12079000	2.94	0.66	3.24E-05	6.33	1.25	3.48E-06	2.57	2.62	3.30E-01	8.44	1.93	4.32E-05	67	25.5
12097500	-7.00	1.88	3.69E-04	5.99	3.71	1.11E-01	-14.72	1.97	<1.00E-06	-15.41	3.59	5.37E-05	75	23.8
12101500	1.15	0.40	5.55E-03	-2.70	1.48	7.23E-02	-5.41	1.66	1.77E-03	-7.29	1.23	1.00E-06	65	23.3
12112600	-4.96	1.93	1.21E-02	-5.58	3.70	1.35E-01	1.67	3.64	6.47E-01	-4.48	6.37	4.84E-01	88	26.7
12114500	5.99	1.49	1.77E-04	17.00	2.29	<1.00E-06	2.07	2.91	4.80E-01	16.29	2.95	1.00E-06	58	20.3
12116500	4.54	0.50	<1.00E-06	-3.75	0.93	1.65E-04	7.52	1.32	<1.00E-06	10.92	1.42	1.00E-06	61	21.7
12141300	1.28	0.33	2.58E-04	-1.30	1.07	2.30E-01	2.43	1.13	3.65E-02	2.46	0.85	5.39E-03	53	21.3
12143700	-4.25	2.46	8.97E-02	-0.57	3.25	8.61E-01	10.66	3.13	1.21E-03	7.44	2.88	1.24E-02	58	21.8
12143900	9.50	2.86	1.52E-03	14.66	2.63	<1.00E-06	12.01	4.18	5.61E-03	30.40	5.05	1.00E-06	61	20.9
12147600	1.98	1.83	2.85E-01	18.07	2.28	<1.00E-06	12.30	4.72	1.19E-02	35.59	4.46	1.00E-06	55	20.1
12148300	2.10	0.48	4.25E-05	5.62	2.51	2.84E-02	-10.28	1.75	<1.00E-06	-0.76	1.52	6.19E-01	68	26.9
12155300	1.00	0.35	5.93E-03	-20.18	1.65	<1.00E-06	-3.58	4.04	3.79E-01	-18.89	4.66	1.49E-04	61	20.7
12301300	2.60	0.50	<1.00E-06	3.69	0.77	4.55E-06	-0.33	0.68	6.24E-01	5.73	0.35	1.00E-06	114	32.8
12304500	-0.66	0.34	5.47E-02	3.01	0.49	<1.00E-06	-2.51	0.69	4.22E-04	-0.70	0.55	2.07E-01	108	34.6
12324200	-2.60	0.20	<1.00E-06	-1.23	0.90	1.74E-01	-8.80	0.76	<1.00E-06	-15.08	1.25	1.00E-06	141	29.9
12330000	-4.17	0.71	<1.00E-06	4.55	0.99	1.14E-05	-0.96	0.93	3.02E-01	-1.42	0.60	1.92E-02	124	32.8
12331500	-8.30	1.52	<1.00E-06	-3.27	2.00	1.06E-01	-1.99	1.96	3.14E-01	-14.40	2.71	1.00E-06	80	27.9
12335500	-11.15	1.82	<1.00E-06	0.69	1.88	7.16E-01	6.93	2.35	3.73E-03	-7.13	1.49	4.41E-06	129	29.3
12340500	-0.47	0.14	1.15E-03	-1.41	0.31	1.26E-05	1.69	0.26	<1.00E-06	0.12	0.28	6.83E-01	104	37.0
12346500	0.00	1.13	9.99E-01	-5.43	0.89	<1.00E-06	-3.65	0.92	1.83E-04	-10.35	1.09	1.00E-06	63	36.1
12353000	-0.39	0.07	<1.00E-06	-0.45	0.19	1.62E-02	2.59	0.44	<1.00E-06	1.61	0.33	3.22E-06	116	33.5
12354500	-0.47	0.06	<1.00E-06	2.71	0.37	<1.00E-06	-5.03	0.37	<1.00E-06	-2.87	0.27	1.00E-06	120	36.3
12358500	-0.44	0.17	9.82E-03	-0.51	0.33	1.24E-01	1.29	0.25	<1.00E-06	-0.02	0.40	9.65E-01	124	32.8
12359800	0.32	0.19	9.85E-02	0.25	0.65	6.99E-01	2.54	0.43	<1.00E-06	3.51	0.58	1.00E-06	125	39.7
12370000	-0.24	0.06	2.14E-04	-1.45	0.14	<1.00E-06	0.18	0.21	3.91E-01	-1.40	0.20	1.00E-06	140	45.1
12372000	-0.68	0.07	<1.00E-06	0.55	0.06	<1.00E-06	-0.19	0.10	5.92E-02	-0.40	0.12	7.00E-04	173	57.9
12375900	7.50	1.41	<1.00E-06	-15.30	1.74	<1.00E-06	-14.59	2.66	<1.00E-06	-25.14	2.61	1.00E-06	105	28.5
12388400	2.75	1.18	2.21E-02	-9.15	1.34	<1.00E-06	-26.35	2.01	<1.00E-06	-31.87	1.61	1.00E-06	88	25.6
12390700	11.25	1.41	<1.00E-06	-8.62	1.59	<1.00E-06	-7.41	1.44	1.20E-06	-6.73	0.75	1.00E-06	112	32.9
12397100	6.20	1.27	5.96E-06	-1.49	0.99	1.39E-01	-0.23	1.35	8.65E-01	4.43	1.48	3.69E-03	76	44.9
12442500	-1.40	0.39	4.99E-04	2.28	0.49	1.05E-05	-2.02	0.73	7.02E-03	-1.21	0.66	6.93E-02	95	27.4
12445000	-0.81	0.36	2.66E-02	3.27	0.39	<1.00E-06	-5.11	0.72	<1.00E-06	-3.44	0.88	1.85E-04	87	28.8
12458000	-1.23	1.44	3.96E-01	6.10	1.40	6.34E-05	-9.85	1.76	<1.00E-06	-4.61	0.74	1.00E-06	54	34.0
12459000	-1.11	0.35	2.67E-03	-0.93	0.59	1.24E-01	1.65	0.49	1.51E-03	-0.68	0.41	1.00E-01	57	25.0
12462500	-0.99	0.28	7.71E-04	3.26	0.89	5.42E-04	2.72	0.68	1.52E-04	4.46	1.12	1.82E-04	64	25.2
12484500	0.06	0.05	2.27E-01	-0.87	0.10	<1.00E-06	-0.56	0.11	<1.00E-06	-1.31	0.11	1.00E-06	238	63.5
12488500	-1.01	0.28	3.28E-04	-3.33	0.35	<1.00E-06	-2.59	0.49	<1.00E-06	-8.93	0.66	1.00E-06	256	57.7
12508990	-4.89	0.47	<1.00E-06	5.96	0.79	<1.00E-06	-0.06	1.13	9.55E-01	0.43	1.05	6.83E-01	85	33.2
13011000	-1.15	0.21	<1.00E-06	2.00	0.59	9.83E-04	-1.21	0.69	8.11E-02	-0.53	0.40	1.91E-01	131	35.0
13018750	1.52	0.48	1.89E-03	4.60	0.79	<1.00E-06	4.69	0.65	<1.00E-06	10.60	0.85	1.00E-06	121	32.7
13022500	0.46	0.25	6.41E-02	2.73	0.30	<1.00E-06	-0.93	0.34	6.30E-03	2.09	0.37	1.00E-06	126	35.0
13027500	-1.69	0.33	1.30E-06	-1.22	0.70	8.56E-02	8.05	0.68	<1.00E-06	4.42	0.48	1.00E-06	135	34.3
13032500	0.57	0.12	6.86E-06	3.36	0.46	<1.00E-06	-1.38	0.35	1.22E-04	2.21	0.50	1.94E-05	121	48.4
13042500	-0.14	0.88	8.77E-01	0.69	1.17	5.57E-01	-2.12	0.84	1.25E-02	-2.15	1.15	6.31E-02	173	35.0
13046680	0.92	0.85	2.82E-01	-2.12	0.93	2.48E-02	0.51	1.33	7.05E-01	0.42	1.52	7.86E-01	76	20.1
13047500	0.24	0.34	4.94E-01	-2.78	0.79	5.47E-04	3.21	0.70	1.02E-05	1.83	0.58	1.91E-03	155	37.4
13050500	0.81	0.13	<1.00E-06	3.95	0.31	<1.00E-06	-1.00	0.29	7.95E-04	3.92	0.35	1.00E-06	137	34.4
13052200	-1.32	1.04	2.06E-01	0.77	1.53	6.17E-01	-6.05	1.97	2.69E-03	-7.24	1.93	2.89E-04	114	39.6
13057155	-0.74	0.24	2.55E-03	0.05	0.76	9.49E-01	-1.73	1.14	1.33E-01	-3.42	1.04	1.60E-03	75	20.3
13060000	0.89	0.25	5.30E-04	1.95	0.37	<1.00E-06	-1.63	0.30	<1.00E-06	1.21	0.28	3.82E-05	129	38.8
13068500	-5.09	0.96	<1.00E-06	-2.21	0.89	1.38E-02	2.36	0.83	5.02E-03	-4.69	1.17	9.75E-05	139	37.0
13069500	0.67	0.08	<1.00E-06	5.97	0.28	<1.00E-06	4.49	0.58	<1.00E-06	11.07	0.59	1.00E-06	161	34.9
13075500	-3.88	0.26	<1.00E-06	1.65	0.42	1.15E-04	-13.02	0.78	<1.00E-06	-14.25	0.71	1.00E-06	150	39.6
13077000	0.13	0.03	1.19E-05	2.96	0.19	<1.00E-06	-1.43	0.28	1.07E-06	1.43	0.28	1.00E-06	195	39.0
13081500	0.04	0.07	5.86E-01	-1.99	0.12	<1.00E-06	1.43	0.44	1.53E-03	-0.59	0.40	1.40E-01	166	32.3
13118700	4.25	1.18	5.45E-04	7.87	2.64	3.74E-03	14.68	2.19	<1.00E-06	27.12	1.40	1.00E-06	86	23.6
13120000	7.47	0.92	<1.00E-06	-10.02	1.53	<1.00E-06	-2.07	1.05	5.00E-02	-3.87	0.63	1.00E-06	110	26.3
13153500	-0.05	0.40	9.04E-01	-1.46	1.17	2.13E-01	5.09	1.22	6.92E-05	2.32	0.73	2.12E-03	93	27.4
13176000	2.42	1.27	5.85E-02	-15.34	1.10	<1.00E-06	-0.13	1.11	9.05E-01	-14.48	1.37	1.00E-06	158	33.6
13200000	-1.05	0.24	1.41E-05	3.16	0.40	<1.00E-06	0.85	0.42	4.52E-02	2.54	0.54	4.27E-06	272	60.8
13246000	0.16	0.49	7.49E-01	3.91	0.80	4.00E-06	-2.06	0.84	1.58E-02	2.39	0.35	1.00E-06	99	26.1
13247500	0.48	0.24	5.00E-02	-1.41	0.48	4.36E-03	1.74	0.38	1.84E-05	0.54	0.34	1.17E-01	88	25.2
13249500	1.85	0.22	<1.00E-06	3.06	0.90	9.24E-04	-4.74	0.95	2.48E-06	0.50	0.37	1.83E-01	110	32.8
13296500	0.38	0.41	3.64E-01	1.32	0.81	1.11E-01	-3.59	0.78	2.52E-05	-0.95	0.43	3.35E-02	54	28.9
13297355	-2.63	1.38	5.98E-02	-15.52	1.90	<1.00E-06	-17.54	2.31	<1.00E-06	-32.78	3.06	1.00E-06	127	38.5
13317000	-0.04	0.19	8.13E-01	-1.38	0.31	3.49E-05	0.55	0.29	6.54E-02	-0.98	0.28	7.72E-04	83	25.0
13330000	-0.78	0.27	4.56E-03	-3.98	1.32	3.12E-03	6.08	1.35	1.75E-05	1.17	0.37	2.15E-03	101	35.8
13334300	0.57	0.45	2.17E-01	0.73	0.46	1.15E-01	1.02	0.63	1.13E-01	1.16	0.53	3.42E-02	41	23.1
13336500	0.08	0.18	6.47E-01	0.97	0.56	8.95E-02	-1.54	0.58	9.75E-03	-1.42	0.41	9.12E-04	94	30.3
13337000	-0.18	0.20	3.86E-01	1.72	0.61	6.66E-03	-0.93	0.78	2.37E-01	-0.08	0.57	8.95E-01	67	21.0
13340000	-2.27	0.43	2.11E-06	0.25	0.53	6.40E-01	1.85	0.47	2.38E-04	-0.40	0.40	3.19E-01	64	20.2
13340600	0.86	0.20	7.47E-05	2.62	0.64	1.13E-04	0.00	0.66	9.94E-01	3.34	0.46	1.00E-06	69	22.6
14103000	-0.40	0.09	6.32E-05	-0.41	0.35	2.46E-01	0.10	0.93	9.12E-01	-0.70	0.99	4.80E-01	64	21.9
14140000	-0.09	1.10	9.38E-01	-4.41	2.49	8.10E-02	9.12	3.00	3.41E-03	2.54	1.13	2.80E-02	63	25.8
14154500	2.19	1.29	9.60E-02	-9.41	1.92	8.86E-06	2.54	2.28	2.71E-01	-1.38	1.79	4.47E-01	57	28.5
14158850	-0.24	0.29	4.09E-01	-1.80	0.42	6.60E-05	4.59	0.63	<1.00E-06	2.34	0.59	1.94E-04	61	28.5
14165000	1.88	0.48	2.22E-04	-0.79	2.40	7.43E-01	1.31	2.11	5.37E-01	2.80	0.87	2.03E-03	66	26.2
14185000	4.36	0.61	<1.00E-06	1.41	1.00	1.65E-01	-1.52	1.33	2.59E-01	3.17	1.00	2.41E-03	58	23.9
14185900	2.17	0.89	1.77E-02	12.12	1.72	<1.00E-06	14.30	2.64	<1.00E-06	25.79	2.19	1.00E-06	68	26.7
14187200	0.62	0.12	2.59E-06	-8.68	0.43	<1.00E-06	-1.39	0.57	1.68E-02	-9.41	0.73	1.00E-06	72	25.5
14194300	-1.49	2.78	5.96E-01	-0.83	2.33	7.26E-01	4.18	2.33	8.55E-02	0.48	2.28	8.35E-01	24	23.4
14208700	-5.36	1.08	4.99E-06	7.64	0.88	<1.00E-06	5.77	0.84	<1.00E-06	8.86	0.83	1.00E-06	71	22.4
14211500	14.09	1.25	<1.00E-06	-17.15	2.50	<1.00E-06	4.02	3.41	2.41E-01	-0.78	3.43	8.21E-01	91	31.3

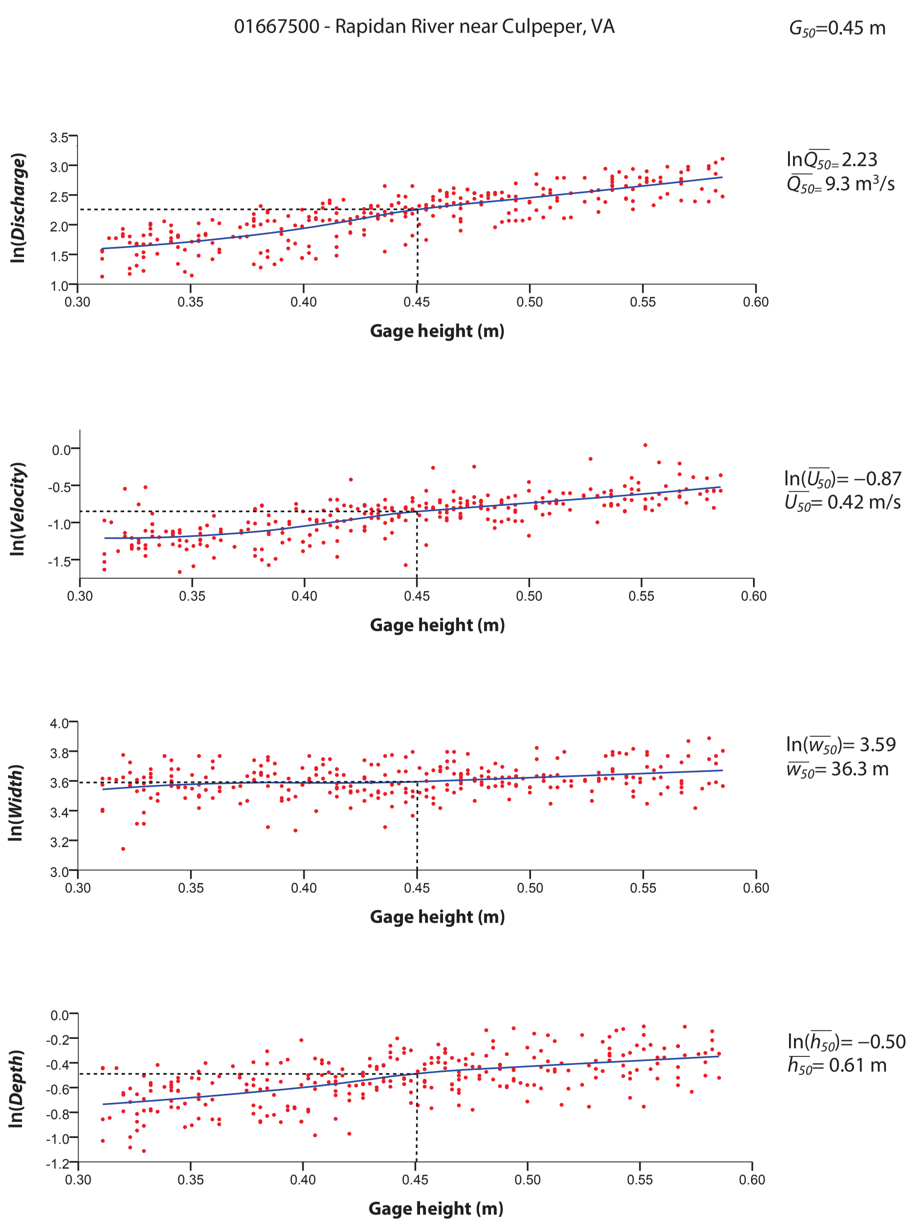
STAID	$\hat{w}$ (%/dec)	$\hat{w}$ SE (%/dec)	$\hat{w}$ p	$\hat{h}$ (%/dec)	$\hat{h}$ SE (%/dec)	$\hat{h}$ p	$\hat{U}$ (%/dec)	$\hat{U}$ SE (%/dec)	$\hat{U}$ p	$\hat{Q}$ (%/dec)	$\hat{Q}$ SE (%/dec)	$\hat{Q}$ p	N msts	N years
14220500	-0.22	0.05	1.14E-05	3.67	0.32	<1.00E-06	-4.44	0.59	<1.00E-06	-0.94	0.48	5.06E-02	118	42.2
14236200	3.09	0.49	<1.00E-06	-5.46	1.39	2.27E-04	-4.25	1.28	1.56E-03	-7.24	1.37	1.87E-06	61	23.6
14306500	1.37	0.57	1.98E-02	-1.71	1.63	2.99E-01	1.27	1.35	3.51E-01	0.83	0.88	3.49E-01	65	27.7
14308990	7.96	1.41	<1.00E-06	-0.68	2.53	7.88E-01	0.96	2.97	7.47E-01	6.72	1.68	1.67E-04	64	22.8
14316500	0.29	0.12	1.88E-02	-0.83	0.27	2.69E-03	0.76	0.31	1.70E-02	1.02	0.25	7.41E-05	99	36.2
14330000	0.93	0.14	<1.00E-06	-0.95	0.29	1.53E-03	-1.95	0.34	<1.00E-06	-2.35	0.33	1.00E-06	131	41.7
14334700	5.43	1.23	3.64E-05	4.96	1.51	1.55E-03	-5.57	1.64	1.13E-03	2.41	0.86	6.24E-03	74	21.4
14337600	0.05	0.13	7.22E-01	-4.04	0.27	<1.00E-06	0.63	0.27	1.94E-02	-2.99	0.27	1.00E-06	132	43.0
14337800	5.51	1.39	1.66E-04	1.16	2.02	5.68E-01	-9.50	3.32	5.40E-03	0.19	1.23	3.81E-01	78	27.3
14359000	-0.27	0.18	1.41E-01	-0.04	0.21	8.40E-01	0.58	0.21	8.11E-03	0.33	0.29	2.55E-01	89	37.4
15041200	4.16	1.46	6.53E-03	-2.01	1.34	1.41E-01	-0.25	0.78	7.49E-01	1.53	0.69	3.20E-02	43	22.2
15294005	-0.11	0.40	7.91E-01	3.82	0.90	9.99E-05	10.18	1.96	4.23E-06	12.37	2.47	3.21E-06	48	30.0
15348000	-2.39	0.80	7.81E-03	1.68	0.76	4.11E-02	-4.07	1.01	7.08E-04	-5.22	0.86	7.45E-06	20	37.0
15356000	-0.42	0.44	3.52E-01	-1.06	0.54	5.41E-02	-0.43	0.20	3.67E-02	-1.90	0.23	1.00E-06	44	44.1
15470000	0.16	0.14	2.83E-01	6.76	1.21	1.34E-06	-0.37	1.68	8.25E-01	6.55	1.42	3.21E-05	46	22.2

8.4. Examples of trends computed in chapter 4

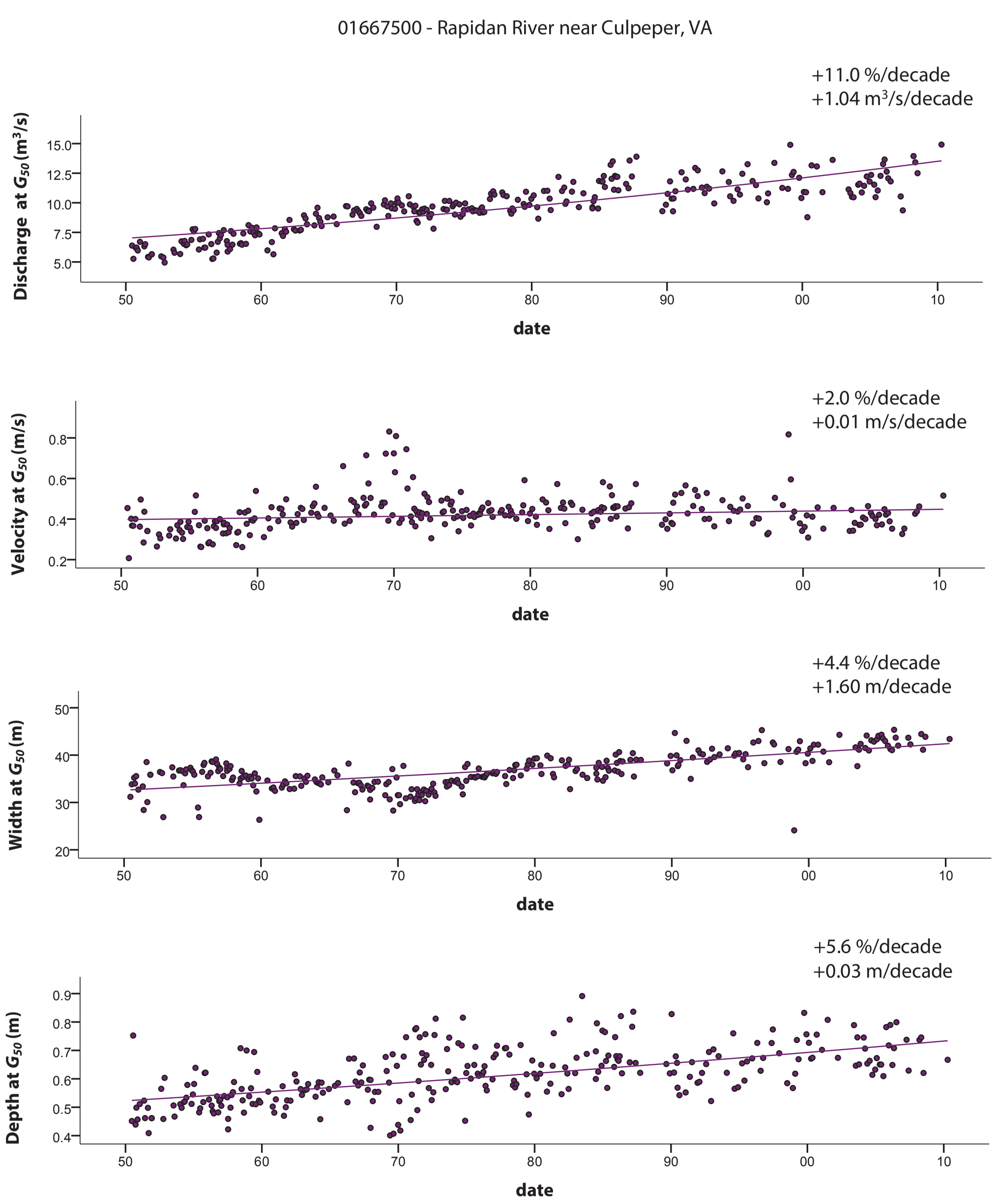
The following pages provide detailed examples at five gaging sites of the trends in cross-sectional discharge, cross-sectional average flow velocity, channel width, and cross-sectional average flow depth that were computed in chapter 4. These graphs are similar to those shown in Figure 4.4.

The graphs on the left side of each page indicate scatterplots relating the natural logarithms of discharge (ln(*Discharge*)), average flow velocity (ln(*Velocity*)), channel width (ln(*Width*)), and average flow depth (ln(*Depth*)), to the stage (Gage height, in meters). Filled red circles represent manual field measurements selected between the 25th and 75th percentiles of the stage distribution (G_{25} and G_{75}, as illustrated in Figure 4.2). The blue line passing through the circles indicates the Locally weighted Scatterplot Smoothing (Loess) fit to the measurements. The location where the median stage (G_{50}) intersects with the log-transformed time-averaged values of discharge, average flow velocity, channel width, and average flow depth is represented as a dashed vertical black line. Residuals are measured as the vertical distance between each red circle and the blue Loess rating curve, and indicate how each channel measurement deviates from the average value on the Loess rating curve, for the corresponding stage (see equations 4.2a to 4.2d). We assume that the residuals are representative of the temporal changes in channel geometry occurring at the median stage, and estimate the values of Q, U, h, and w at median stage (at the time each measurement was made), as the sum of $\overline{Q_{50}}$, $\overline{U_{50}}$, $\overline{w_{50}}$, or $\overline{h_{50}}$ and each individual residual (see equations 4.3a to 4.3d).

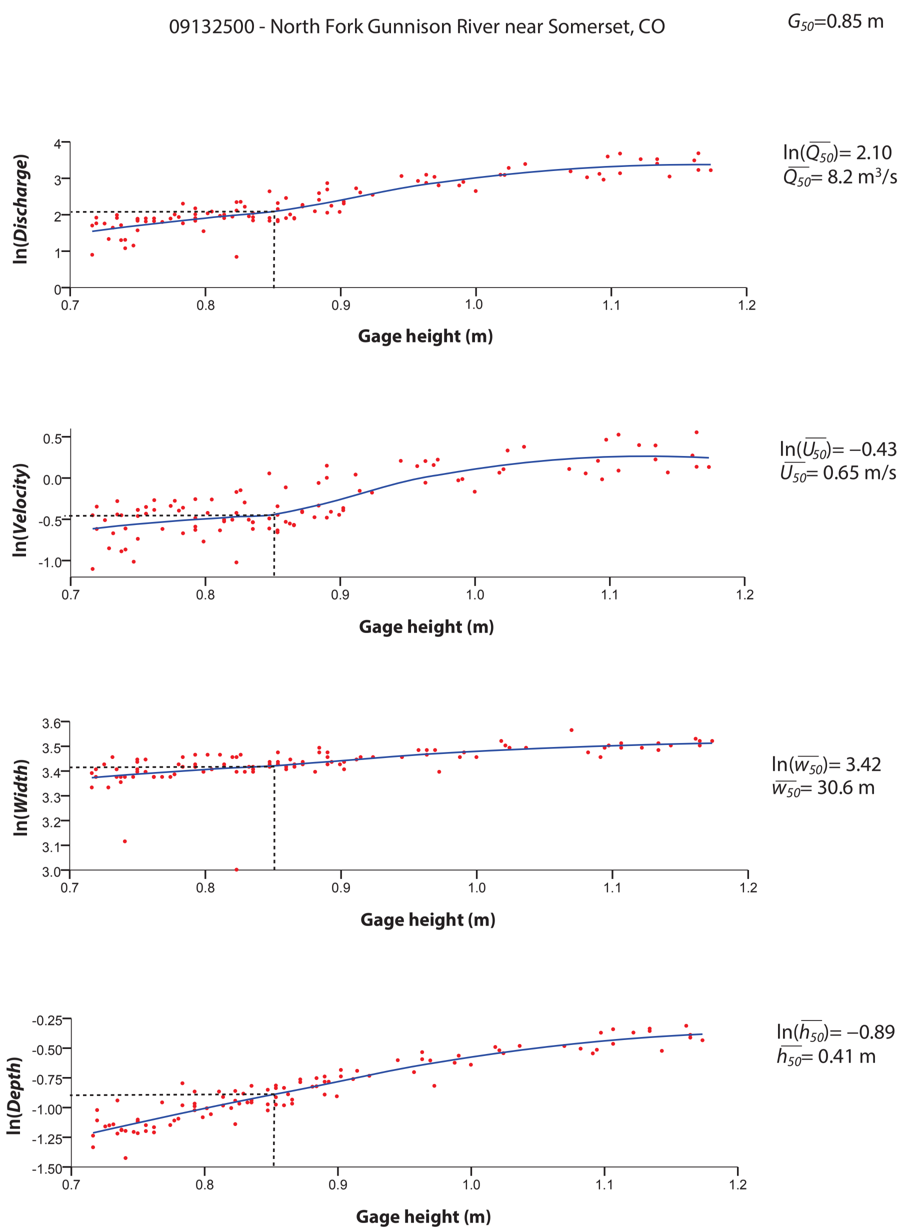
The graphs on the right side of each page indicate the trends in the estimated values of channel discharge ($\hat{Q}$, m^3/s), average cross-sectional flow velocity ($\hat{U}$, m/s), channel width ($\hat{w}$, m) and average cross-sectional flow depth ($\hat{h}$, m) at the median stage (G_{50}, m) over time. Purple filled circles indicate the estimated values of $\hat{Q}$, $\hat{U}$, $\hat{w}$ and $\hat{h}$. The purple curves passing through the estimated values are the mean-unbiased Iteratively Reweighted Least Squares (IRLS) trends. Note that the curves are exponential, but that the curvature is indistinct for many sites due to the scatter in the underlying data.

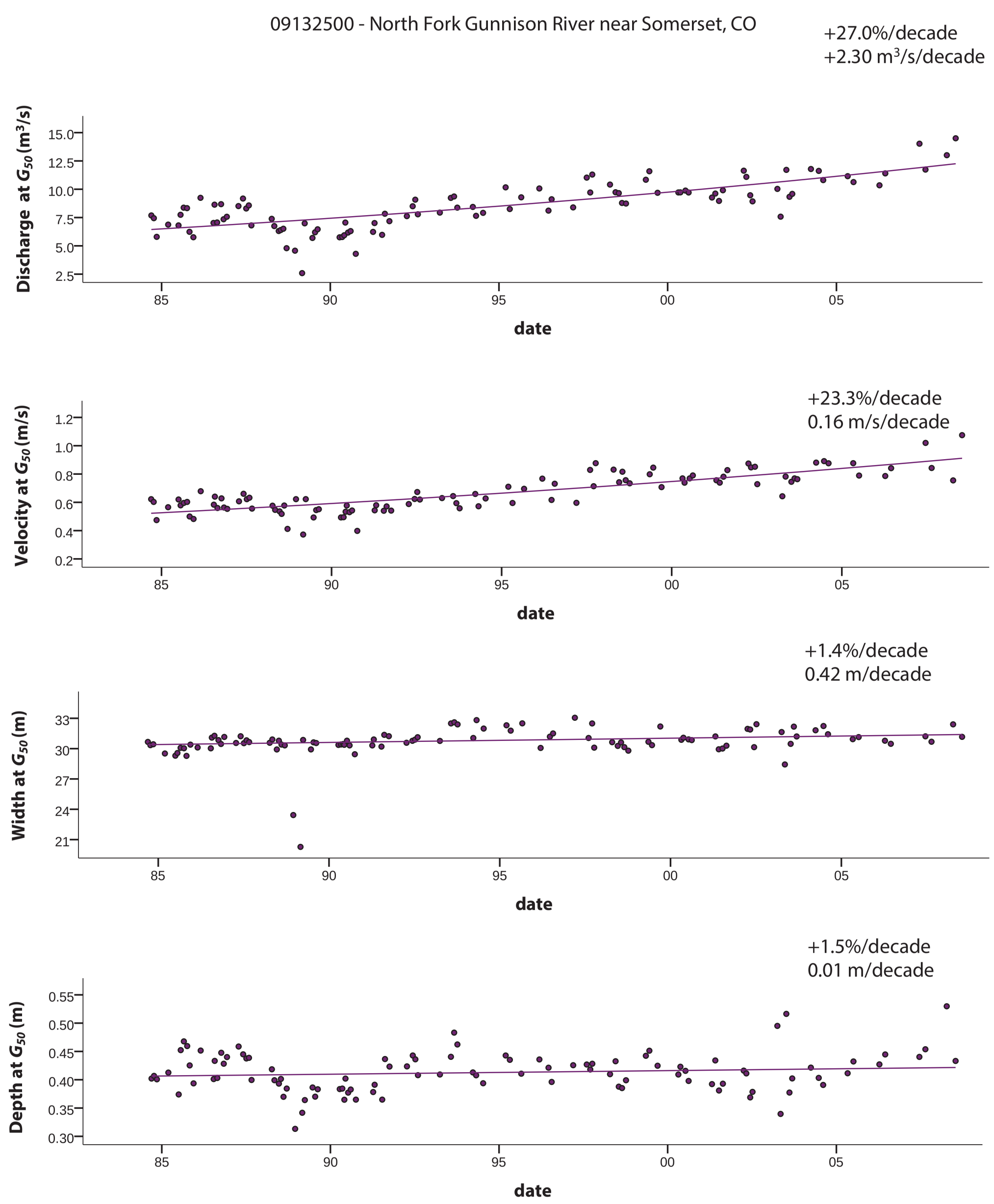


01667500 - Rapidan River near Culpeper, VA
G_{50}=0.45 m
ln$\overline{Q_{50}}$= 2.23
$\overline{Q_{50}}$= 9.3 m^3/s
ln($\overline{U_{50}}$)= −0.87
$\overline{U_{50}}$= 0.42 m/s
ln($\overline{w_{50}}$)= 3.59
$\overline{w_{50}}$= 36.3 m
ln($\overline{h_{50}}$)= −0.50
$\overline{h_{50}}$= 0.61 m
ln(*Discharge*)
ln(*Velocity*)
ln(*Width*)
ln(*Depth*)
Gage height (m)



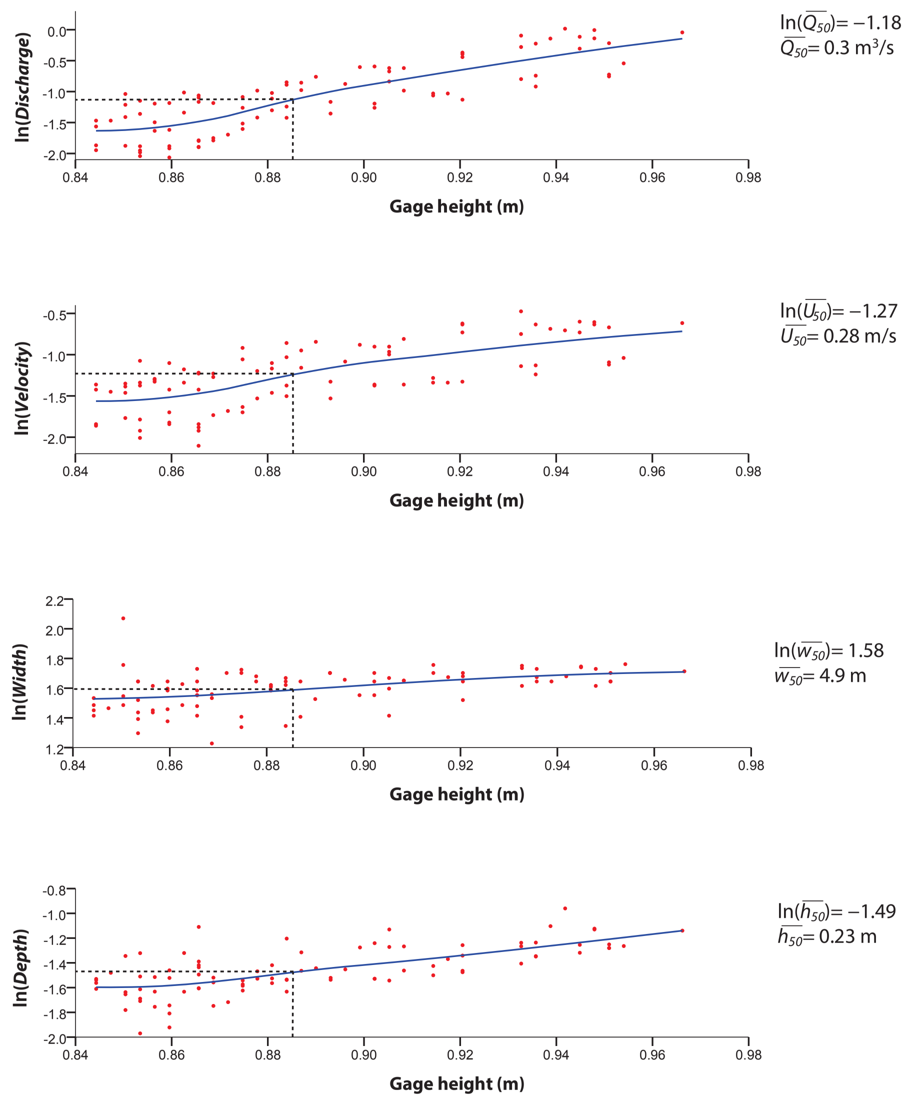
01667500 - Rapidan River near Culpeper, VA
+11.0 %/decade
+1.04 m^3/s/decade
+2.0 %/decade
+0.01 m/s/decade
+4.4 %/decade
+1.60 m/decade
+5.6 %/decade
+0.03 m/decade
Discharge at G_{50} (m^3/s)
Velocity at G_{50} (m/s)
Width at G_{50} (m)
Depth at G_{50} (m)
date


09132500 - North Fork Gunnison River near Somerset, CO
G_{50}=0.85 m
ln($\overline{Q_{50}}$)= 2.10
$\overline{Q_{50}}$= 8.2 m³/s
ln($\overline{U_{50}}$)= −0.43
$\overline{U_{50}}$= 0.65 m/s
ln($\overline{w_{50}}$)= 3.42
$\overline{w_{50}}$= 30.6 m
ln($\overline{h_{50}}$)= −0.89
$\overline{h_{50}}$= 0.41 m
ln(Discharge)
ln(Velocity)
ln(Width)
ln(Depth)
Gage height (m)

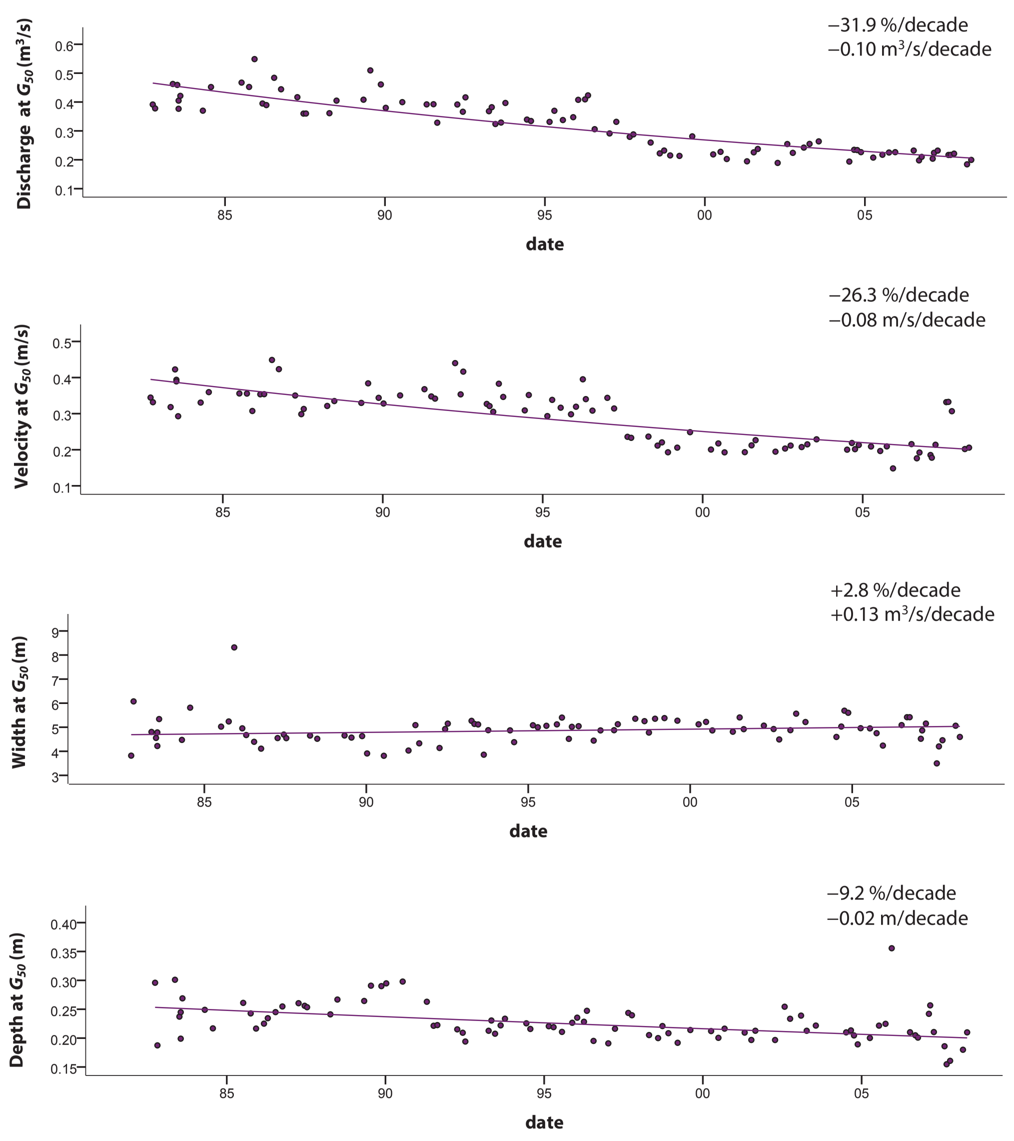

09132500 - North Fork Gunnison River near Somerset, CO
+27.0%/decade
+2.30 m³/s/decade
+23.3%/decade
0.16 m/s/decade
+1.4%/decade
0.42 m/decade
+1.5%/decade
0.01 m/decade
Discharge at G_{50} (m³/s)
Velocity at G_{50} (m/s)
Width at G_{50} (m)
Depth at G_{50} (m)
date

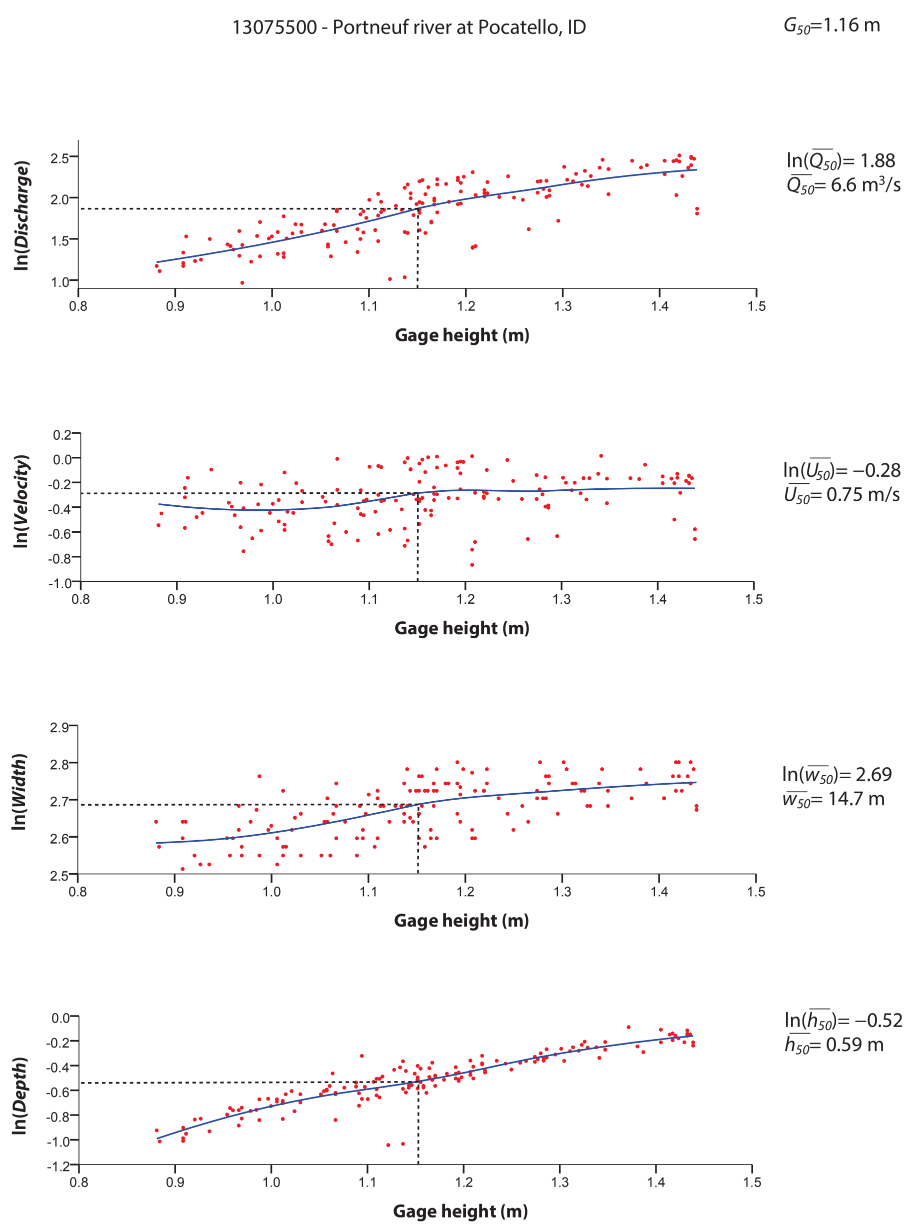
12388400 - Revais Cr bl West Fork nr Dixon, MT

G_{50}= 0.88 m

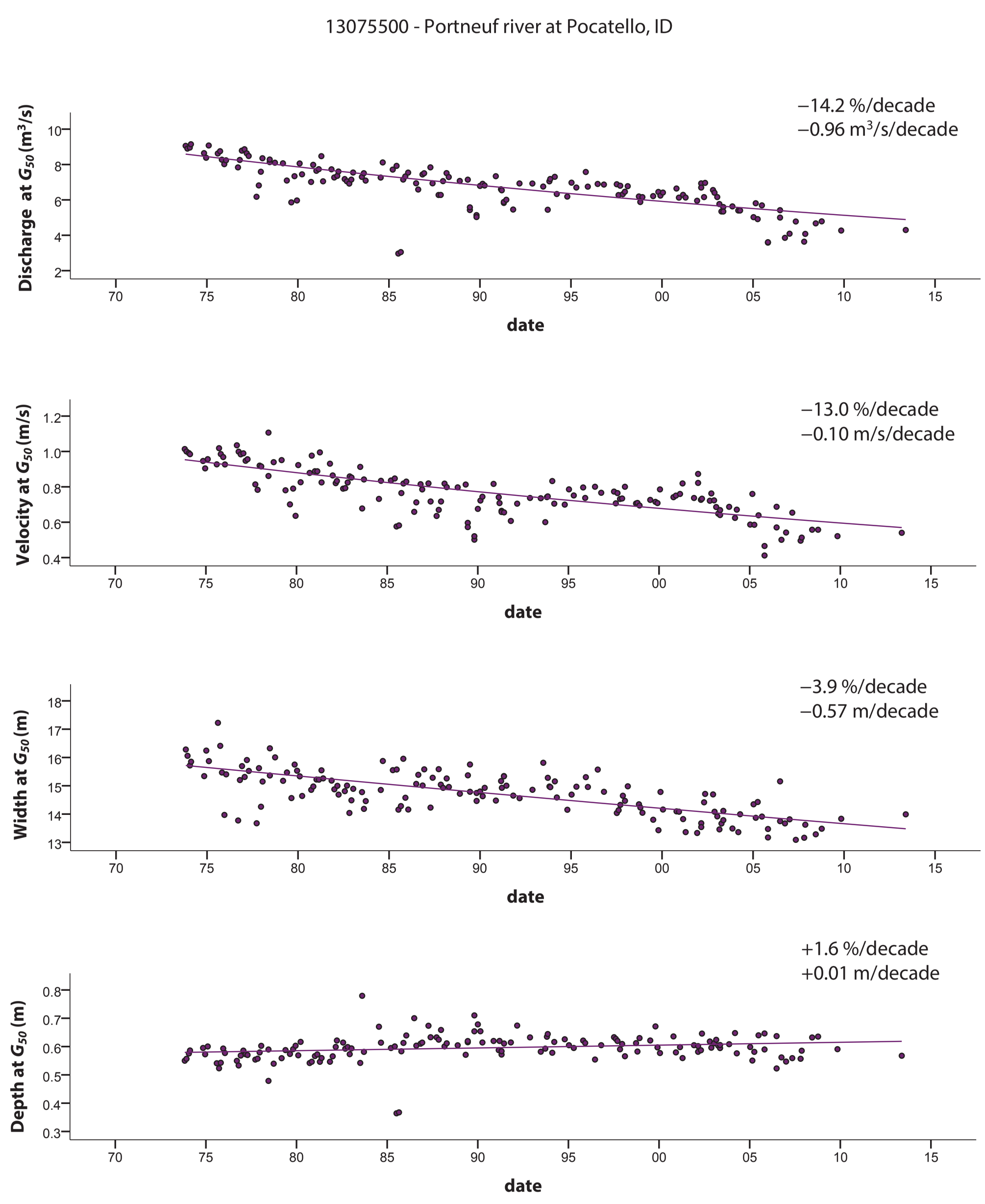


12388400 - Revais Cr bl West Fork nr Dixon, MT

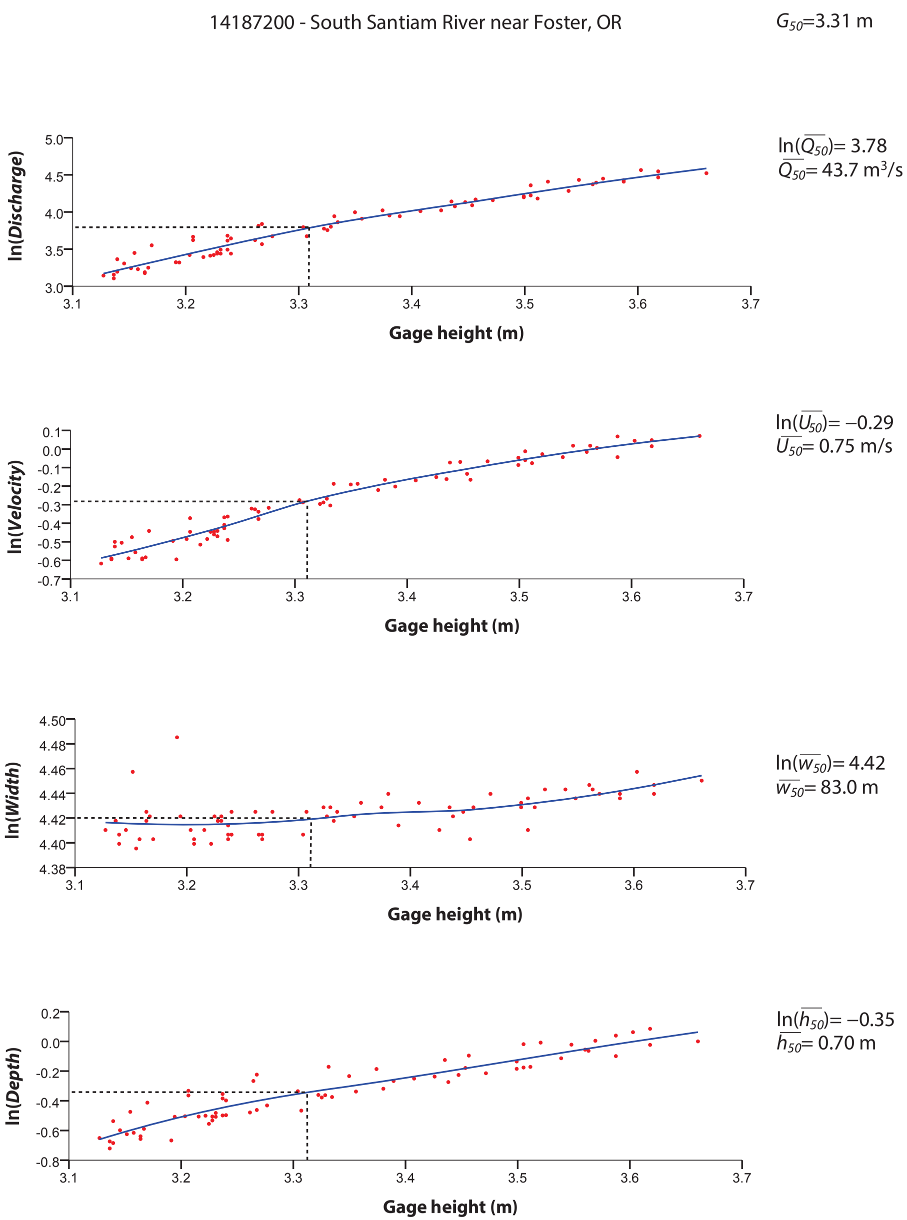


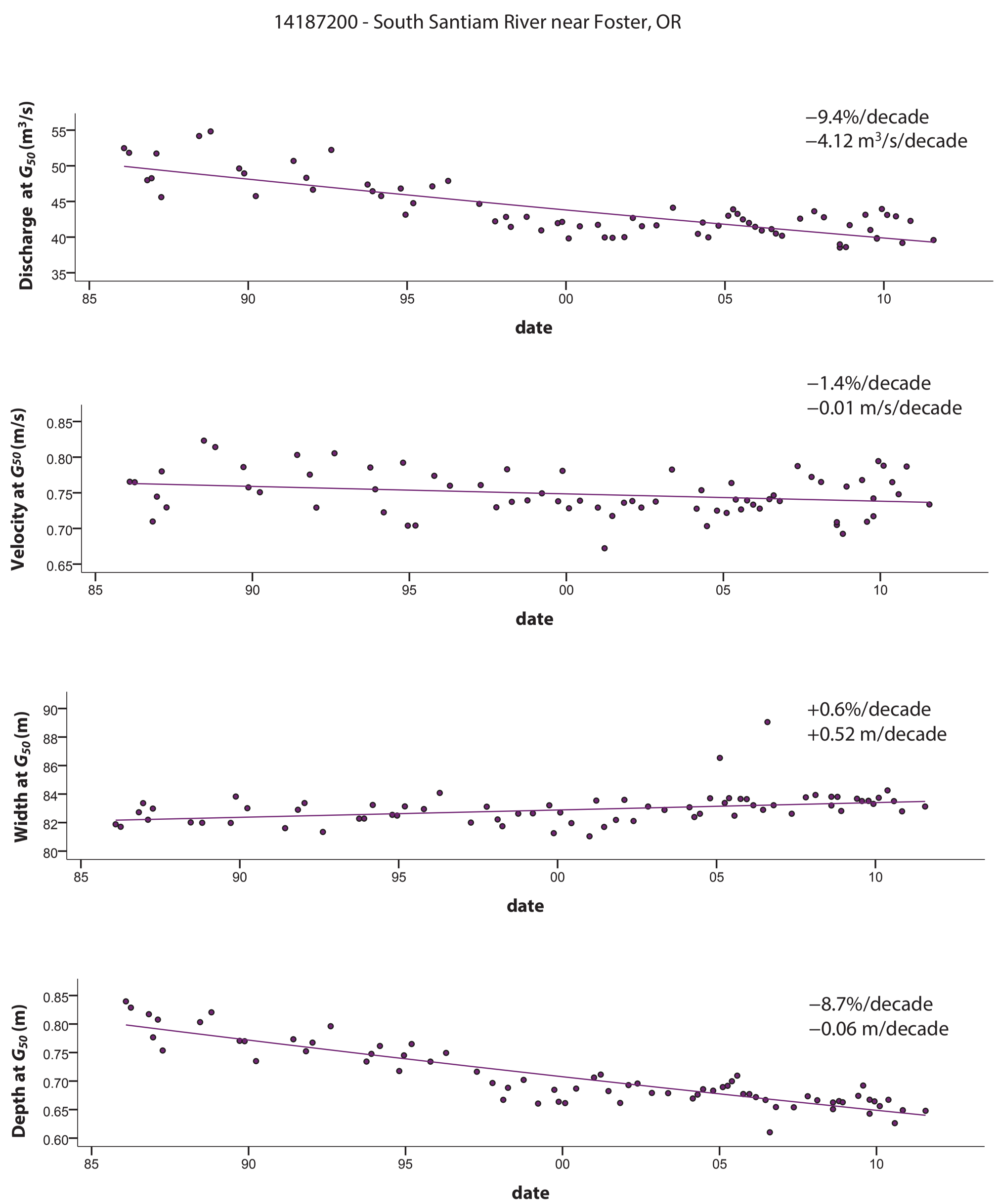


13075500 - Portneuf river at Pocatello, ID
G_{50}=1.16 m
$\ln(\overline{Q_{50}})$= 1.88
$\overline{Q_{50}}$= 6.6 m³/s
$\ln(\overline{U_{50}})$= −0.28
$\overline{U_{50}}$= 0.75 m/s
$\ln(\overline{w_{50}})$= 2.69
$\overline{w_{50}}$= 14.7 m
$\ln(\overline{h_{50}})$= −0.52
$\overline{h_{50}}$= 0.59 m
ln(*Discharge*)
ln(*Velocity*)
ln(*Width*)
ln(*Depth*)
Gage height (m)



13075500 - Portneuf river at Pocatello, ID
−14.2 %/decade
−0.96 m³/s/decade
−13.0 %/decade
−0.10 m/s/decade
−3.9 %/decade
−0.57 m/decade
+1.6 %/decade
+0.01 m/decade
Discharge at G_{50} (m³/s)
Velocity at G_{50} (m/s)
Width at G_{50} (m)
Depth at G_{50} (m)
date


14187200 - South Santiam River near Foster, OR
G_{50}=3.31 m
ln($\overline{Q_{50}}$)= 3.78
$\overline{Q_{50}}$= 43.7 m³/s
ln(Discharge)
Gage height (m)
ln($\overline{U_{50}}$)= −0.29
$\overline{U_{50}}$= 0.75 m/s
ln(Velocity)
Gage height (m)
ln($\overline{w_{50}}$)= 4.42
$\overline{w_{50}}$= 83.0 m
ln(Width)
Gage height (m)
ln($\overline{h_{50}}$)= −0.35
$\overline{h_{50}}$= 0.70 m
ln(Depth)
Gage height (m)


14187200 - South Santiam River near Foster, OR
−9.4%/decade
−4.12 m³/s/decade
Discharge at G_{50} (m³/s)
date
−1.4%/decade
−0.01 m/s/decade
Velocity at G_{50} (m/s)
date
+0.6%/decade
+0.52 m/decade
Width at G_{50} (m)
date
−8.7%/decade
−0.06 m/decade
Depth at G_{50} (m)
date